AMERICAN MACHINIST

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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

The Davey Safety Engine, as Adapted to American Practice.

The problem of furnishing a cheap and safe motor when only small power—from one-half to five or six horse-power—is required has received a good deal of attention from mechanics and engineers. It cannot be expected that as a rule such engines will be in charge of first class engineers, so they must be simple in construction and arrangement, and the element of danger, in case of neglect, must be absent. In cities small motors are generally used in crowded buildings where the danger of loss of life is correspondingly great in case of accident, and this consideration, or the fact that to secure immunity from accident high-priced attendance, that the amount of work to be done will not warrant, must be paid for, leads to a good deal of hand work being done that might profitably be done by power, and to a considerable extent operates to hinder the establishment of small industries.

The engraving represents an American adaptation of an engine and boiler of English design, in which the purpose is to supply small steam engines so constructed as to be operated by those of little skill in handling steam engines, and which at the same time shall be absolutely safe against the possibility of explosion, however unskilfully handled.

It is a low-pressure condensing engine, in which a pressure of only one atmosphere is maintained in the boiler, which, as pressures are commonly spoken of, or shown on the steam gauge, is no pressure at all.

The boiler is of cast-iron, the part above and back of the furnace being cast in partitions, which serve the purpose of flues, giving the necessary heating surface, and which are not likely to be burned out or destroyed even if the boiler were fired without water.

No safety valve is used, but a hole of large diameter covered by a plug laid loosely over it, prevents the accumulation of more than one-quarter of a pound gauge pressure. Ordinarily the pressure in the boiler is just sensibly less than that of the surrounding atmosphere, so that the plug is held down by the pressure of the latter. Practically, however, the internal and external pressures are balanced, so there is no pressure whatever tending to either burst or collapse the boiler.

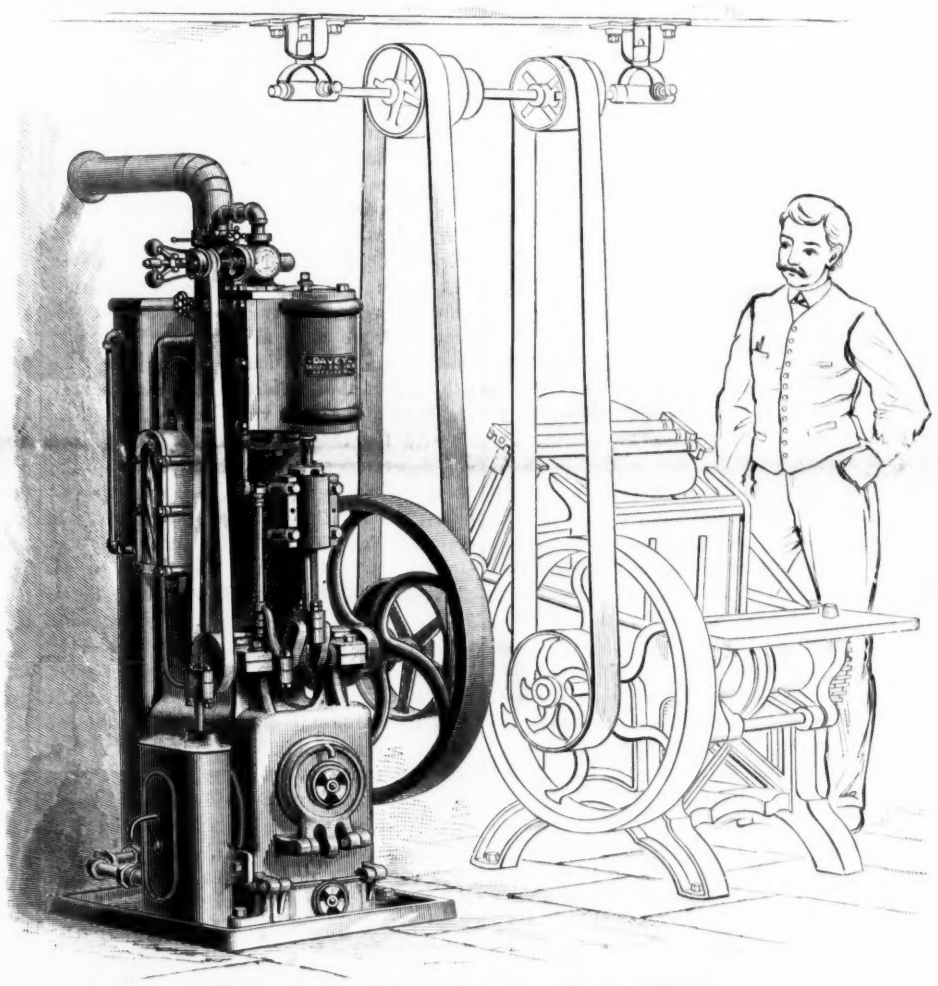
The surface condenser is a casting open at the top, and provided with tubes in which the exhaust steam is condensed, the water and air being removed by a small single-acting air pump, of the plunger type. The top of the condenser is above the water level in the boiler, and the overflow from the condenser is at the top. The small head of water in the condenser (above the water level in the boiler) is utilized for feeding the boiler, as follows: Connection is made between the top of the condenser and the water space in the boiler by means of a small pipe. In this pipe is a cock, controlled by a float in the boiler. When the water falls in the boiler the cock is opened, the water running in by gravity. When the water rises the cock is closed. The water level is thus automatically maintained without the use of a pump, or any attention from the attendant. A glass panel in the side of the boiler provides for observing the water level.

The condensing water may be taken direct from the service pipes in cities, or, where this is not practicable, a small pump driven by the engine may be used for circulating the water. When the engine is used for pumping water the water may be passed through the condenser. When water is scarce it may be used over and over by standing long enough to cool; or the condenser may be located directly in a tank of water.

The engine is double acting, with diameter of cylinder sufficient to give the rated power at a mean effective pressure of eight or ten pounds, which is easily maintained by the air pump. The cylinder is brass bushed, and the piston is of brass, no lubrication being required. The cylinder is steam jacketed around the body and at the ends. In general construction the engine does not differ materially from any small engine. The speed is controlled by a sensitive governor, which responds as quickly to changes of load as if controlling steam of high pressure. The wearing parts are large, doing away with the probability of causing trouble from heating.

Although new in this country these engines have already come considerably into use in Great Britain and France, published tests of their performance showing good economical results. They are suitable for all kinds of light work, including furnishing power for small electric light plants, as in country residences, and seem to be particularly suited for household purposes, where their absolute safety will commend them.

They are manufactured, under license from the patentee, by Chas. P. Willard & Co., Chicago, Ill.; and sold by the New York Engineering Company, 64 Cortlandt street, New York, where the one from which the engraving was made may be seen in operation.



DAVEY SAFETY ENGINE DRIVING A PRINTING PRESS.

Motive Plant in Theaters.

The motive plant in a modern theater will rival in magnitude that of many manufacturing establishments. Taking as an example the Lyceum Theater, in New York City. There are two high-speed engines, each driving a dynamo for the electric lights, of which between 400 and 500 are in use. These engines develop about 25 horse-power each. Another high-speed engine provides for ventilation, and for heating in winter and cooling in summer. This engine drives a 5-foot fan, which constantly forces air into the room. In the winter this air is heated by being drawn to the fan through a space traversed by steam pipes. In the summer these pipes are filled with water, and the space around them with ice, amongst which the air must pass on its way to the fan. The air is delivered through small apertures at each seat. A fourth engine is used for raising and lowering a part of the stage during the performance. This plant is in operation for about six hours out of the twenty-four, and must be in charge of a thoroughly competent engineer, as for obvious reasons no stoppages are allowable.

Weeding Out the Shop in Dull Times—Kind of Machinists Needed—Neglecting Gauge Cocks.

BY JAMES F. HOBART.

When times are getting better, business beginning to "pick up," and the outlook is decidedly brighter, then all the machine men want more help, and listen to the chap who drops in to "get a sight" at a job. When the dull times came along, Rushton was running sixty hands in his shop. When orders began to get scarce he commenced to sort out the "bums," the chaps who had big heads Monday or Tuesday mornings; next the "sojers," "time killers," and "general loafers" got the run. As business decreased the poorest hands were set up in "sleeper counting," and shop expenses were getting down to hard pan.

"Just my luck," grunted Tim. "Old man Rushton can keep eight or ten of them slow grubbers all winter, and I can do twice as much as they can. Talk about fair play and a free country! That's played out in this neighborhood." And Tim sticks his calipers in his breeches pocket and starts off down the railroad track toward the city.

There are thousands of men like Tim. They call themselves machinists. They got a chance to scrape castings in a foundry, worked ten days, and left; went to Rusher's shop, and got a job running a thread-cutting machine. Two weeks was all the time Tim wanted to hurry up that machine when he heard that Savage wanted a man to run an upright drill; so down Tim went and got the job.

What work he made with that machine! Drills were broken, chucks knocked out of time; twist drills, the cutting angle of whose edges had been calculated by a "college professor," were ground in shapes awful to behold. Watch him drill a hole. A broken leg of a machine has had a forging made to fit between the webs, and Tim has got to drill four holes through both leg and forging. He marks the forging with a center punch, puts a flat $\frac{5}{8}$ drill in place, and "goes for" the job. The forging is laid on a 6″ block, the spindle run down and the feed thrown in gear, and Tim begins to look around for his grease cup. It is on that horse just beyond his reach; he lets go of his work and grabs it up. His drill has got in one-fourth of an inch, no oil, and is squeaking like a fiddler's nightmare. He greases the drill; it smokes as it wobbles around like a young eccentric. "What ye doin' there, Tim," said the boss, who chanced to pass; "what ye runnin' that drill so fast for?" "There," said Tim, "I didn't notice it was on the fast speed." But it was, for Tim had been using a $\frac{1}{8}$″ twist drill on the last job, and the machine was running just as fast as when the small drill was in use.

Tim changed the belt. No good; it still smoked. "Take it out and look at it," said boss. Blue and soft Tim found the drill, with the edge all gone.

Business was rushing, orders way behind,

and "the old man was short of men; so they coddled Tim up, showed him a little, berated him more, and let him abuse the lathes, break drills, and turn out poor work until the rush was over. But just then Tim, who had come to the conclusion that he had "learned the machinist's trade," heard of a chance at Rushton's shop, went down and let himself for a "first-class machinist."

It took Rushton's boss just half a day to get the hang of Tim. He knew the cut of his jib as quick as Tim took hold of a chipping hammer, but he knew the whole story before Tim had drilled a hole through two pieces of iron. "Smick, mick, chunck," went the drill, as it went through a piece of iron, caught on the under side burr and chips, and jerked the iron out of Tim's hand and waltzed it around that drill table, carrying the skin of Tim's knuckles with it. Boss sized Tim up then and there, and always put him to work on some day work where good fits were not needed and time could be charged for.

"Send down a good man right off," came from the telephone. "What's the matter?" "Slipped an eccentric," was the reply. Did Rushton send Tim? No; he knew better. Tim is turning poor pulleys for the Wildcat Mining Company, and Rushton is charging them fifty cents an hour for it, with doubts of getting his money, and he don't intend to risk losing a good customer by sending him a man who "don't know how." He sends young Kendall, who began four years ago, just about the time Tim began to chip castings.

Kendall knows something. He knows how to *see* things. You don't have to tell him every time that a drill will catch when it goes through a soft piece of wrought iron unless you "let up" on the feed. He knows that a lathe tool is not working right when it snaps and sputters, scrapes off a broken chip, and smokes like a spark in your breeches pocket. You send him to that engine, and he will take a monkey wrench and common sense with him. If he gets stuck, he won't be apt to hustle things and spoil something, and he is not at all apt to get stuck.

When the dull times came along we found Tim, with his greasy rule and calipers, just taking a run. Young Kendall stayed in the shop. No fear of his going on a tramp this year. The poor men go first, but the men who *know how*, or can *learn*, are always in demand.

Tim worked six months chipping castings, and came out a good shop hand; he bunged up machines a year or two longer, and set up for a first-class machinist. We have lots of such chaps in America. They make trouble in the machinist business, and then go to chopping cord-wood for their living.

Experience is a first-rate thing to have. It is the best teacher we ever had in the shop, or out of it, either; but it won't do a man a particle of good unless he *knows how* to learn.

Our shops are going to want lots of machinists for the next ten years. The rust will get, scraped off slide rests, and the dust of months or years has got to be brushed out of leading screws and back gears. We shall want lots of machinists, too, and we want some that can *learn how*. We don't want any tool-breaking, bungling scrubs. We want men who can reason, and find ways and means; who can work with their brains, and not bungle with their hands.

When this kind of a chap comes along we take him in and—keep him. If lots of big orders make men scarce, and Tim gets another job, he will begin just where he left off, and jamb and bungle until poor times come again. Then, perhaps, he will light out as a "stationary engineer," and fire a boiler and tinker an engine for $1.50 per day, until he comes in some zero morning and knocks out a cylinder head, or his old boiler blows up, and Tim quits the machinist business in a cloud of brickbats, low water, and burnt boiler plates. The coroner's jury hunt up the most of him on a verdict of "mysterious explosion," and bury the remains of a man who *didn't know how*.

One day, not long since, an engineer in Chelsea, Mass., couldn't keep up steam. He had a good fire, and the water-line glass was half full of water, but the steam kept running down. The pump had been running slowly all the forenoon. It kept the water just about right in the glass, and everything seemed lovely, until the steam pressure began to fall.

The engineer was "stuck." The old Utica engine was doing its level best, but the work in the machine shop was too much for it. When the engine got down to thirty revolutions per minute, and every lathe was running at half speed, the boys began to shift their belts to get more speed; but this made it worse for the engine, and the boys began to drop into the engine room to see what the matter was.

Boss had got out there, and he was flying around for all he was worth. Everything seemed all right, but the engine was stopping. Only fifteen pounds of steam. The steam pump had almost stopped. Boss took hold of the valve to shut off the steam. He turned it the wrong way, and opened the valve instead of closing it. The pump started faster. The engineer shut down the engine and came into the boiler room. "That acts funny," said the old man. "I'm going to get out of here."

"Say," he said, as he turned around in the doorway and looked back, "s'posin' you just try one or two of them gauge cocks." The boss turned pale and jumped for the boiler front. "Stop that pump!" he yelled to the engineer, and opened the middle cock. Steam came out blue as it could be at the pressure, which had worked up to twenty-five pounds since the engine stopped. Blue steam from the lower cock! The hair on boss' head began to stand up. "Pull out your fire, engineer," he shouted. Too late. Just as engineer got to the pump the steam gauge hand gave a little jerk. A smothered puff sounded in the boiler, and blue steam came out of the fire-box, and ten machinists made first-rate time through the doorway.

There were four sections of cast iron boiler with nice cracks along the bottom of each. One water-line glass connection was plugged up. One scared engineer *never* will trust to water glass again without trying gauge cocks every fifteen minutes. The pump had been running slow all day. It did not pump a drop into the boiler. It leaked. The cast iron sections got almost red hot. When boss turned the valve the wrong way, he started the pump fast enough to overcome the leak. Five or six gallons of water went on the hot iron and cracked it. Boss has done lots of thinking since then, as to "what might have been."

"Mitis" Wrought Iron Castings.

BY MR. T. NORDENFELD, LONDON.

A PAPER READ BEFORE THE IRON AND STEEL INSTITUTE.

I have the honor to draw your attention to the samples of wrought iron castings which I have been allowed to exhibit to this meeting. They represent what I believe to be an entirely new method of producing iron or steel, especially mild steel, in forms and for objects which have not up to the present been attained as cheaply and perfectly as I believe this method will enable a manufacturer to do it. It will be seen that the castings are flexible and weldable to a degree which has hitherto only been produced by the very highest class of wrought iron forgings. The main point is that we have succeeded in making a commercial success of melting wrought iron, or rather iron with a low percentage of carbon, and casting it into the shapes required by the trade. I am aware that Sir Henry Bessemer, Mr. Crampton, and others have melted wrought iron in even larger quantities than what might be called laboratory experiments, but I would like to claim that before these "mitis" castings were perfected, as they now are, no manufacturer has succeeded in melting wrought iron under conditions which have enabled the manufacture to be carried out commercially, although upon this point I am in the hands of the meeting, and I would be glad to hear whether we have a right to claim this for our system or not. I have called our produce "wrought iron castings," because they are made of wrought iron alone, without any other additions than such chemicals (physics) as we have found most suitable for our purposes, and I have called these castings "mitis" castings, in order to give them a name which specifically applies to their qualities, and which name can be easily remembered, even if not understood, by every workman who may have to use them—the Latin word "mitis" meaning, of course, mild, flexible, or ductile.

The origin of this invention, as I must call it (although during the last twenty years so many powerful minds have given their intelligence and energy to develop the manufacture of iron and steel, that there seemed to be but little room for anything new) is as follows:—We had at Carlsvik, in Stockholm, a malleable iron foundry, which fairly succeeded in producing good malleable castings, but we did not succeed in making these castings so absolutely free from faults that I could use them in my gun manufacture. The trade for malleable castings in a small country like Sweden being of course limited, we adopted the method originated by Mr. Wittenstroem, assisted by the experience of Mr. Ludwig Nobel, of dynamite and petroleum reputation, and the results of a couple of years' experiments by Messrs. Faustman and Oestberg and myself, with the guidance of Mr. Wittenstroem, are what you now see before you. We, then, last year pulled down our malleable foundry, and put up a comparatively large foundry for making "mitis" wrought iron castings, the first brick of the foundry being laid in September last year; the first castings in this new foundry were produced in January of this year, and we have already found, not only that we can make much better articles than before, but that, whereas our trade in malleable castings was very limited, we have already for these "mitis" wrought iron castings much larger orders for consumption in Sweden than we can see our way to execute. The raw material we first used was Swedish wrought iron scrap, such as horseshoes, rivets, etc., and the castings we obtained from this raw material were found to have about 20 per cent. higher tensile strength than the wrought iron used—the tensile strength being 24 tons per square inch and upwards—and this percentage of gain in strength has been maintained for other raw materials. We could not at first see that our castings were in any way less pliable or ductile than the Swedish wrought iron used as raw material, and you will observe from the samples, all of which are bent cold, that the castings show as good a quality in this respect as can possibly be expected from wrought iron forgings. When, however, we tested the material for elongation, we found that the elongation of the castings was slightly less (from 5 to 10 per cent. less) than that of the Swedish wrought iron. This is also natural enough when you consider what had been done by melting the wrought iron. We got rid of all slag, and at the same time we were free from all risks of the delamination and imperfect welding occurring in wrought iron forgings. Our castings are, therefore, more dense than wrought iron, and have practically no fiber; they have the same tensile strength in all directions, this advantage being obtained at the cost of the slight loss of elongation caused by the absence of slag, and by the virtual absence of fiber. But, although there is theoretically some slight loss in elongation, I think you will admit that the samples before you prove that practically the elongation and ductility are fully sufficient for even the most severe requirements.

We do not alter to any considerable extent the chemical properties of the material we use, and I need hardly say that I do not claim that we improve (more than already stated) the actual raw material used. What we put into the pot we get out of it, with such alterations only as are caused by the treatment to which we subject it: therefore, if we use iron free from all impurities, we obtain exceedingly good castings, and if we use iron with a very large percentage of phosphorus we naturally obtain proportionately brittle and unsatisfactory castings. In order to ascertain how much impurity we can deal with, I sent over to Sweden last January a number of different qualities of English iron, and I found that whereas the most impure scrap gave castings too brittle for practical use, a purer iron, such as refined iron from Middlesborough, gave us castings to all intents and purposes as good as the best English forgings, while such perfect raw material as hematite puddle bars gave us castings which were equally as good as, if not better, in every respect, than, those produced from Swedish wrought iron scrap. We found that raw material containing $\frac{1}{4}$ per cent. of phosphorus was too impure to prevent brittleness in the castings; but when we mixed two-thirds of scrap containing $\frac{1}{4}$ per cent. of phosphorus with one-third of refined iron, hematite, or Swedish iron, we obtained castings quite satisfactory for general purposes; when we mixed half and half we obtained castings quite as ductile as, and much stronger than, ordinary forgings; while using refined Yorkshire iron, hematite, or Swedish iron alone, we obtained castings which I may be allowed to call "extra" quality, that is, their ductility (as shown by the samples) probably exceeds what can be produced by forgings, while their strength is fully 20 per cent. greater in all directions than the best wrought iron forgings.

All the above-named mixtures, with less than $\frac{1}{4}$ per cent. of phosphorus, give us castings which can be welded and mended like wrought iron without the slightest trouble. It seems to me that what we do might be said to be that we make exceedingly mild steel by melting the wrought iron almost free from carbon, instead of making mild steel by decarbonizing pig iron which contains about 3 per cent. of carbon. Good pure cast iron would probably not be a much cheaper raw material than the above-named mixtures of wrought iron scrap, while, on the other hand, we do not require the costly apparatus of the Bessemer and Siemens manufacture, and the very inconsiderable cost of our furnaces would enable our castings to be made on a much smaller scale than those made by the Bessemer and Siemens methods; while, on the other hand, those methods may produce very heavy castings more cheaply than we can. This will also probably be found a more economical way of using up scrap than any other. The manner in which we make the "mitis" wrought iron castings is as follows: You will see that the samples show an unusually clean surface, and the iron runs, perhaps, more perfectly than in the best cast iron castings. This, of course, means that we use a very great heat; in order to obtain this heat we melt the wrought iron in crucibles placed in furnaces, each containing six crucibles. Each furnace has one fire, and we work two crucibles together; the pair farthest away from the fire is warmed to a certain degree by the waste heat, the second pair is heated also by the waste heat to a point where the scrap approaches its melting temperature, and in the pair nearest to the fire the wrought iron is completely melted. As this last pair is lifted out, the second pair is moved forward into their place, the third pair is moved forward into the place of the second, and a fresh pair of filled crucibles is placed in the compartment furthest away from the fire. In order to obtain quickly the great heat required, we employ as fuel the residuum of petroleum, called naphtha, which is easily obtainable in unlimited quantities, and which is not in any way dangerous. We have tried this residuum from American petroleum, from Glasgow, and from Baku, and they all work equally satisfactorily; and we have tried other forms of volatile oil, which also works well with slight modification in the furnaces, but which in most places would be found more expensive than the naphtha. From these furnaces we can draw eight to ten pairs of crucibles per day of twelve hours, and when we, as we intend to do, commence

working day and night shifts, we can cast fifteen to twenty times every twenty-four hours. This is a considerable gain, as I believe that in Sheffield the crucibles are taken out only about three times in twelve hours; and we have the further advantage that we refill each crucible every time by its full charge of about 60 lbs. of scrap, whereas in Sheffield a full charge of 60 lbs. is only put into a new crucible, their second charge being about 50 lbs., their third about 45 lbs., and so on. Our next step is to deal with this exceedingly hot iron. We have carried out a method of moulding and facing sand which works to our entire satisfaction, as shown by the samples, and we have made use of water moulds of a special construction when a great number of castings have to be made to the same pattern. In order to do this expeditiously and cheaply we use a ladle, in which we keep the iron at its full heat by means of a surface blast of very hot gases, and we fix a number of moulds around the circumference of a turntable in such a manner that one mould can be filled after the other as quickly as it is brought under the lip of the ladle, and the castings are immediately taken out of the moulds, so that each mould is ready for refilling as soon as it comes round again under the lip of the ladle.

The raw material being wrought iron only, the castings do not require to be in any way annealed, but are simply cleaned up by emery-wheels, or otherwise, and delivered to the purchaser. As the iron runs so exceedingly free without large heads, and as it falls out of the moulds so easily, this method of "Mitis" wrought-iron castings must tend to save labor to a very important extent, and we have already found that it enables us to considerably lighten and greatly vary designs—such as designs of machinery, etc.—as we can, without extra cost, shape our moulds, so that we give the strength of metal where wanted, but only where wanted, whereas in forgings it would often not pay to complicate the shape. This method also enables a constructor to make much bolder designs, and of more difficult forms, knowing that such designs can be easily and cheaply carried out. Here again we find great advantage in being able to weld the castings as we can cast the parts, which would otherwise be difficult to forge, or which would require much machining, and weld them on to a bar or rod as required. Some of the samples show links, bearings, and clutches used in this way.

I can hardly imagine any form of forging which it would not be more advantageous to cast by this method. You see before you the most difficult forms, such as pulleys, smoke-consumers, wheels, knees and bends of piping, etc., which give the tensible strength of mild steel forgings without any greater expense than for castings of ordinary shapes, except what may be caused by the greater trouble in making the mould. Our work at present is principally limited to such castings as would compete with malleable castings, because that was our trade previously, and because we were lucky enough to find that the malleable patterns came in exactly without any alteration for our "Mitis" castings, the contraction in both cases happening to be the same. The cost of our "Mitis" castings being practically the same or perhaps slightly lower than that of our malleable castings, all our customers are, of course, very glad to have the "Mitis" castings instead of the others, as they are so much more strong and ductile, and as the decarbonization in malleable castings is apt to destroy the iron in very thin pieces, whereas in castings of comparatively larger dimensions the decarbonizing of course only acts near the surface, while the main portion of the malleable casting remains brittle cast iron. As a matter of fact we are not only paid much higher prices for our "Mitis" castings than we were paid for the same castings made of malleable iron, but we cover a much larger field of work, because of our "Mitis" castings being used for a great many purposes for which malleable castings could not even be thought of.

As we have more to do than we can provide for in these smaller castings, I have as yet had hardly any experience in castings of larger dimensions, but I have no doubt that we shall ultimately arrive at larger castings, and that we shall be able successfully to deal with the contraction in articles even exceeding two or three inches in thickness; but at present I see such an extensive field for smaller castings, where this method has no competition other than drop-hammer forgings, because our steel-makers are not prepared to cast very thin or intricate articles, that it seems to me of no use as yet to compete in the sphere of such larger castings as can be easily produced from a Bessemer or Siemens furnace, or from the ordinary crucible. We have also lately made some very successful steel castings with a higher percentage of carbon, some samples of which, unpolished as well as burnished, I have brought here. These promise well for the future, the surface being exceedingly clean and taking a very high polish, and we have tried them successfully for ordinary edged tools; for instance, we cast at present some of our tools for the gun factory in Stockholm, and we cast them ready to shape, after which we have only to harden and grind in order to make them ready to put into use. These steel castings we also make out of wrought-iron scrap as raw material, adding the quantity of pure pig iron required to bring up the percentage of carbon to the point required for each different purpose. I do not mean to say that tools can be made better by this method than by the ordinary methods, but it is certainly a more direct way than to make wrought-iron bars into blister steel and then smelt this blister steel in a crucible, and my method is certainly cheaper, seeing that pure scrap can be obtained at a very much lower figure than the bars, and that my tools are cast ready to shape. There can be no risk of sufficient wrought-iron scrap not being procurable to enlarge the "Mitis" casting business to any extent; but, if scrap were to become scarce, the difference of 25s. per ton between scrap and puddle bars would only represent half a farthing per pound in the cost of the castings. I cannot help thinking that this, like other means of saving manual labor, while it may be opposed at starting, is certain in the long run to extend the use of iron and steel so much further that quite as many workmen and blacksmiths will be employed in the future as at present, though their labor will be more profitably employed in this work than in making forgings by the old process.

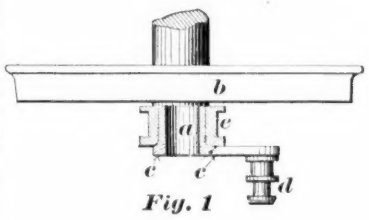


Fig. 1

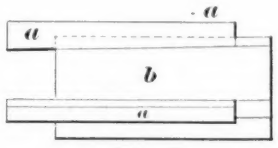


Fig. 7

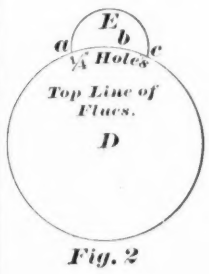


Fig. 2

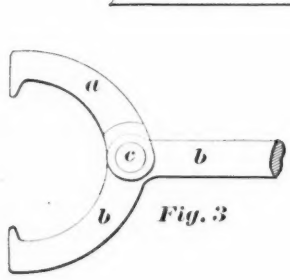


Fig. 3

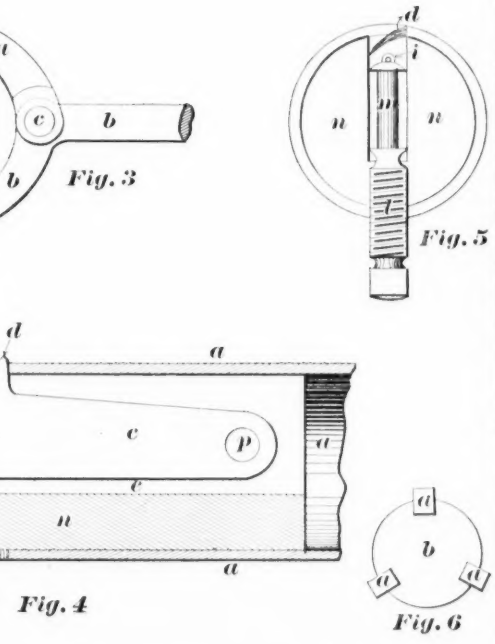


Fig. 4

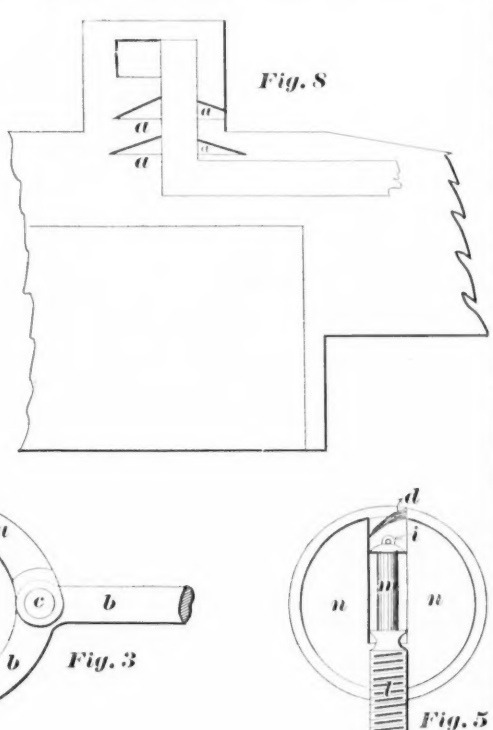


Fig. 5

Fig. 6

Fig. 8

Florida Railroad Notes.

BY FRANK C. SMITH.

During a recent visit to Florida I met Mr. J. D. Hollister, superintendent of the Florida Southern Railroad, and formerly general master mechanic of the Savannah, Florida & Western Railroad. The Florida Southern is narrow gauge, and, like all Florida roads, suffers badly from drifting sand, which in that respect greatly resembles snow, as it is frequently necessary to stop a train and all hands set to work with shovels clearing a foot or two of sand from the track. As may be imagined, the running and valve gear of the narrow gauge engines, being very low, suffer badly from cutting, the motion of the engine whipping up a constant cloud of the sand ballast. I saw an engine, out of the shop but a month, in which there was ½" lost fore and aft motion in the valve stem, this being, of course, the combined amount clear back to the main shaft.

To do away with this, Mr. Hollister proposes to build an outside frame engine, using the Joy or a similar valve gear. Fig. 1 shows the plan, *b* being the tire, *a* the axle, extending through the wheel on the outside; *c* the crank, which is bored out at the shaft end and pressed on to the axle end, the driving-box bearing being on the outside of the sleeve of the crank; *e* being a section of the driving box; the crank pin *d* is solidly a part of the crank *c*. This arrangement would not only throw the valve gear, etc., outside, where it is believed it would not suffer as badly from the sand, but would also allow of a considerably wider fire-box, a consideration of great importance in narrow gauge engines.

The boiler for this engine was to be domeless, a half-circular steam drum, *E*, Fig. 2, taking the place of the dome, the shell of the boiler proper beneath *E* to be full of $\frac{5}{16}$" holes, the throttle valve being in the smoke arch. It is believed that this arrangement will give much drier steam.

At Mr. Hollister's shops I saw an adjustable spanner wrench, shown in Fig. 3, which had so wide a range as to fit anything in the shop or on the engines. The arm or leg, *a*, was pivoted to the body of the wrench *b* at *c*. As the arm *a* could swing in or out, it was adjustable to any size practicable.

Mr. Hollister gave me an idea of a flue cutter for removing flues from the boiler, in place of using a chisel, the scheme being to leave the body of the flue cut off squarely and ready to piece out without the usual squaring-up after removal. As I understood the plan it was something as shown in Fig. 4, Fig. 5 being an end view on a line with the screw *l*. In Fig. 4 *a*, *a* is the flue, *b* the flue sheet, *n* the body of the flue cutter, *e*, *e* a slot planed in the body up to the point *f*, *g* a collar on the body to rest against the beading of the flue, *h* a square for a wrench, or ratchet which would be handier. The cutter *c* is forged to the width of the slot. This cutter is pivoted at *p* with a counter-sunk bolt; *l* is a screw threaded into the body of the cutter. An extension *m* of the screw *l* passes up through the cutter *c*, the opening for *m* being large enough to allow for the path of the cutter at this point following the arc due to the pivoted point *p*. A washer and pin at *i* is fitted. The cutter point is at *d*. By screwing up the screw *l* the cutter *c* is raised, forcing the point *d* to the flue, when by turning the whole rig by means of the square *h*, the flue is speedily cut off as squarely as could be wished for, leaving the flue ready to be pieced out. In practice it would be better probably to locate the cutting point *d* farther to the right, so as to leave the piecing out piece longer, that is, locate the weld further from the end of the flue. It would undoubtedly prove a handy and expeditious tool.

Mr. Hollister runs a foundry in connection with the shop. His arrangement for breaking up car wheels is very simple and effective. A chunk of round iron *b* has three tapering grooves planed in it, see Figs. 6 and 7. Three steel wedges slip into these grooves, and the whole is slipped into the axle hole of a car wheel. It is then placed in a wheel press, the ram bearing on the ends of the pieces *a*, *a*, *a*, forcing them in, the tapered bottom causing them to also raise. The result is the wheel is generally split into three or four pieces, each piece being full of cracks, so that a tap from a sledge is only necessary to break the pieces into still smaller pieces. Mr. Hollister informed me that he had always found an effectual cure for engines given to raising their water, in a couple of tapered sleeves *a*, *a*, Fig. 8 on the upright or lifting pipe. The water evidently uses this pipe as a ladder to climb up on, which of course the sleeves prevent.

A Jackson, Mich., correspondent, referring to a note in one of our recent issues about changes on Michigan Central Railroad writes: "S. M. Edgerly, of Jackson, general master mechanic of the Michigan Central locomotive department, resigned May 1, and was superseded by C. R. Smart, of Bay City, a division master mechanic at that place for the same road. This gentleman is a first class machinist and has worked himself up by degress to the position he now holds. He was superseded by Michael Ryan, of this city, formerly an agent in foreign countries (in Russia especially) for the Grant Locomotive Works. Messrs. Behan and Bruce are at their old places as foremen of round houses. The M. C. R. R. has but one repair shop on this side of the river. It is located here, and Hon. R. C. Stewart is the general foreman. This company is now trying the Richardson Balanced Valve, and putting spark arresters with extended smoke arch on all their 18"×24" passenger engines. They are also introducing steel crossheads and abolishing cast iron ones."

At this writing there are more signs of activity in iron industries, especially in blast furnaces, than for some time past.

Improved Double Disk Sand-Papering Machine.

This machine is designed for sand-papering blinds, doors, panels, casings, jambs, etc. The two disks employed run in opposite directions, one of them being adjustable by hand wheel at the end of the machine; one disk is also self-yielding for irregular work. It is claimed that with this machine 150 pairs of blinds can be sand-papered in ten hours, or other work in proportion, no hand work being required to finish.

It is manufactured by the Williamsport Machine Company, Limited, of Williamsport, Pa.

The Oxydation of Metals and the Bower-Barff Process.

A PAPER PRESENTED BY WM. H. WEIGHTMAN, NEW YORK, AT THE MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

In connection with the able paper by Geo. W. Maynard, on the Bower-Barff Rustless Iron process, the Society will perhaps permit me to present the following report of Lieut. Col. A. R. Buffington, Ordnance Department National Armory, Springfield, Mass., as of considerable value not only from the information contained, but from the freedom accorded for use of the process defined and developed by Col. Buffington.

The report is made to the Chief of Ordnance, U. S. A., and is as follows:

NATIONAL ARMORY,
SPRINGFIELD, MASS., Oct. 7, 1884.

SIR—Within a few days past I have been called upon by the Department for remarks relative to the "Bower-Barff process" of oxydizing the surface of iron and steel for preservation. To-day a representative of the parties controlling this process called upon me with specimens of their work, one a piece of gun barrel. In this way the subject has again been called to attention, and at the same time the discovery is made, by a comparison of work and a fuller knowledge of the Barff process, that a method now in use at this armory is superior to it for the oxydation of parts of small arms. Six or seven years ago the Barff process, so far as my knowledge extends, was made known in this country, and attracted my attention relative to the oxydation of parts of small arms, but my interest extended no further; the difficulties attending the application and the high degree of heat required, presenting obstacles I did not care to encounter experimentally. Some time after, either immediately before or after my change of station to the Watervliet Arsenal, I saw a public notice of a lecture in England in which it was stated the lecturer asserted the oxydation of iron and steel surfaces by the application of melted nitre to be the magnetic or peroxyde of iron. This, or a similar notice, was seen by one of the assistant officers at Watervliet, and he called attention to it and suggested that it be tried, which I instructed him to do with the lariat rings there manufactured. The result proving satisfactory, the rings were thereafter, up to the time of my leaving the arsenal, so colored.

About this time, being on a board of officers in New York with the late Colonel Benton, then in command of the armory, I called his attention to the subject with a view of applying the process to parts of small arms. He soon after died, and no further action was taken until some time after I succeeded him here, when my attention was again called to it by the master armorer observing the coloring of some metal, oxydized by nitre, which I had brought with me, and asking how it had been done.

I then began experimenting, but succeeded only at first, with the help of one of the workmen in securing a good color for the tip of rifle stocks. This part, malleable iron, had always been case-hardened. The case-hardening, besides not coloring uniformly, injured the files in fitting the rammer to the groove in assembling the arms. From this success, without entering into details, we have progressed until now tips, bands, band-springs, guards (fully assembled), and butt-plates are colored with the nitre, and some experiments with barrels, after one (the first) rusting of the present browning process, would indicate that it is but a question of time until all metal parts of the rifle not requiring to be hardened are so colored. But after the success with the tip when the process consisted simply in immersion in melted nitre at about the melting temperature, after a blueing made in the ordinary way with heat (the malleable iron, it was found, required this preliminary blueing), a change was made. Whether the resulting satisfactory work is due to that change, or simply the result of more skill and judgment acquired by practice, as to degree of heat, time of immersion, etc., I am unable to say. The change consists in putting in the vessel with the melted nitre a few pounds of peroxyde of manganese. It was known to me that the presence of this mineral increased, without any chemical change in itself, the oxydizing properties of chlorate of potassa. Why not as well the nitrate of potassa? I tried it with the result as above. I have made no secret of this whole matter, and it has already attracted the attention of one private arms company to the extent of coming here to see and learn the process. But it has occurred to me, the armory process being superior in color (to the specimen of gun barrel shown), economy, and simplicity of application, and the heat required not affecting the temper, which the Barff process does, of tempered parts subjected to it, the United States should be secured in the use of this valuable method without payment of royalties, by the publication of the history of its use here. The simple oxydation of iron and steel by nitre could not be patented, as books of chemistry have long ago published it, but the process as above described might be.

I therefore make this report with a view to its speedy publication. The method used here, in brief, is as follows: A cast-iron pot or vessel, open to the air, built into a furnace of fire-brick and heated from below, contains the nitre and oxyde of manganese at a temperature sufficiently high to cause ignition and combustion of a *pinch* of sawdust thrown upon the surface of the nitre. The parts to be subjected to oxydation are suspended by wires from a stationary hook above the pot, in the centre of the nitre: after immersing and moving them about through it so as to stir up the mixture, the parts are put in cold and *finished*, excepting color, and left suspended as above from five minutes up, depending on the size and color required. After the lapse of the required time, or after satisfactory color is obtained, which can be determined by raising the charge out of the nitre and looking at it, it is plunged into a vessel of hot water to cool and remove the adhering nitre; then into oil, completing the process.

Respectfully your obedient servant,
(Signed) A R BUFFINGTON,
Lieut. Col of Ordnance.

Since preparing the above for presentation to the Society, I have had the pleasure of a direct communication from Col. Buffington, which, like the official report to the Ordnance Department, is substantially brief and to the point.

The communication is as follows:

April 18, 1885.

WM. H. WEIGHTMAN,
82 Astor House, New York, N. Y.

DEAR SIR—In reply to your request of the 17th inst., I take pleasure in stating that the process of oxydizing by nitre has been improved to the extent of assured success, but there is little to add to the publication referred to. All metallic parts of the Springfield rifle, except the parts requiring to be case-hardened and the small parts colored in tempering, etc., are now oxydized by nitre, and by it simply as related in said publication without any preliminary or after process, except in the case of the stock tip, malleable iron, which requires the previous blueing heating in the ordinary way on a plate. The rifle barrels require to be immersed in the nitre *vertically*, which is done on a suitable fixture holding eight or ten arranged cylindrically around a central rod having an eye for hooking to a small pulley block of a set above, arranged for lowering the barrels into and raising them out of a deep pot containing the hot nitre. After withdrawal, the barrels are left suspended in the air for the nitre to drip off and to cool about the temperature of boiling water, into which they then are immersed vertically, as in the nitre. An after immersion in a bath of oil (sperm) completes the process.

The barrels are treated in this way to prevent any *springing* and *set* from the perfectly straight and finished condition in which they are before treatment. They are colored *inside* and out; the nitre having unrestricted access to the interior. The uniformity of product, the beautiful color, the economy of time, labor and material, the simple and inexpensive plant, mark this process as an important advance in the manufacture of small arms.

A comparison by application to a smooth revolving wheel of the "browning" oxydation with the nitre as to durability gives a ratio of about 5 to 3 minutes in favor of the nitre; and a blow on a barrel colored by nitre does not remove the coloring, leaving a bright spot, as is the case with browning.

The degree of heat required varies, but not much, with the part to be colored. Whether the highest used is sufficient to heat to a redness visible in the dark, I am unable to say, as I have not tested it. The use of pyrometers has not proved satisfactory; such as I have used are unreliable, and dependence is placed on the experience of the workmen.

The cast-iron vessels for heating the nitre, if perfectly sound castings, will last indefinitely. An imperfect one is liable to crack, break and precipitate the nitre into the fire. An accident of this kind will fill the room suddenly with a dense, suffocating gas, but not otherwise dangerous—explosion does not appear possible in the absence of sulphur and charcoal.

The fire may be made either with hard or soft coal. I have tested the matter as to explosion by pouring the nitre into a red hot ladle, and again emptied at once a large ladle full upon the hot coals of a soft coal fire with no other result than a sudden filling of the room with the gas aforesaid. Care should be taken to allow no oil, bits of wood, charcoal, in short, any combustible matter or water to fall into the melted nitre or be introduced into it with the parts to be colored. Minute explosions on the surface and in the nitre take place occasionally and are attributed to oil or bits of combustible matter adhering to the metal parts immersed in it. Care should be taken also when heating up a pot filled with melted nitre cooled into a solid mass. The bottom heating first melts the nitre in contact, producing the evolution of oxygen before the nitre above melts. This oxygen is soon under tension, and will escape with more or less violence as soon as it can find passage through the melting nitre. The vessel should therefore have a weighted cover until the whole of the nitre melts.

No accident has happened here in the use of the nitre beyond the cracking of an imperfect pot, and I look upon the process as a perfectly safe one.

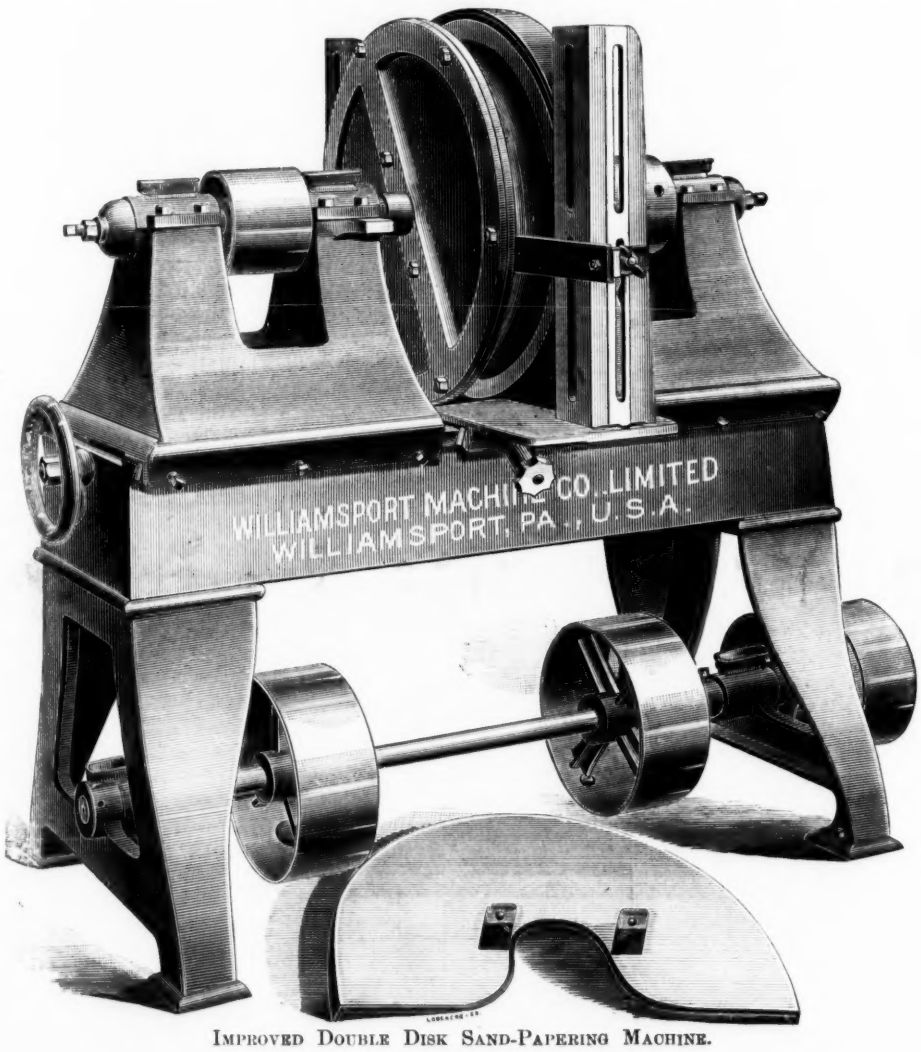
The nitre should be pure—should be refined. The crude nitre of commerce will not give satisfactory color—it will not be uniform. Parts are found occasionally spotted and streaked. These are treated a second time, with the desired result.

The streaking is attributed to some peculiar structure or inferiority of metal.

A surface perfectly smooth and free from the markings of the polishing material, but not highly polished, appears to be the most favorable for the action of the nitre.

A smooth, polished surface of *cast* iron treated with the nitre is given a very pretty bronze color, which might be desirable for cast-iron products to which, in whole or a part, such surfaces are given.

Respectfully yours,
A. R. BUFFINGTON,
Lieut. Col of Ordnance Commanding.



IMPROVED DOUBLE DISK SAND-PAPERING MACHINE.

Female Engineers.

(From the *Greenville, S. C., News.*)

Robert Yergin, a one-armed ex-Confederate soldier, of Dial's Township, Laurens, has a daughter of whom he can be very proud. She has for several winters acted as engineer, running her father's engine to gin cotton, using her books even while at the engine for self-improvement. By her self-application, energy, and industry, she has made money enough to educate herself, first teaching, then attending school. She is now in the graduating class of the Columbia Female College, has been elected to write her class valedictory address, and holds the position of first honor in her class. Miss Yergin is now seventeen years of age, handsome and intellectual. She bids fair to run a bright and useful career in a lady's proper sphere. Miss Mary Yergin's younger sister, Miss Lilah, fourteen years of age, now runs her father's engine, and promises to follow in her elder sister's footsteps.

(From the *Wichita Eagle.*)

All the engineers on this end of the Fort Scott road accompanied the remains of McDaniels to Fort Scott last Saturday. On Sunday it was found necessary to send a train out to the Ninnescah bridge with material, and, no engineers being on hand, Mr. George N. Bauman put his daughter Bessie, a school-girl, in charge of the engine, furnished her with a fireman, and she did her work nobly, handling the throttle and guiding the iron steed as well as the best man on the road. Bessie has frequently run the engine about the yard, but never before made a trip on the road. We don't know of any other road having female engineers.

The wife of an engineer and light-house keeper for the U. S. Government, when her husband is absent on business and detained, will in case of foggy weather get up steam on the boiler, start the engine and attend to the signaling as well as it is done by her husband, and the machinery as arranged is not without considerable complication.

The central station of the Municipal Electric Light Company is in South Fifth Street, Brooklyn. The engine which furnishes the power has a heavy fly-wheel, which runs in a pit. When the engine was started one night this week, a cat, which made its home in the station, was on one of the spokes in the pit, out of sight of the engineer. The wheel was soon making twenty revolutions a minute. It was impossible to rescue the cat from its perilous position without stopping the engine, and that would break every circuit and put out all the lights dependent upon the dynamos in the station; so the unfortunate animal had to ride on until the engine was stopped at the usual hour for putting out the lights. The cat then dropped exhausted from the wheel, but soon revived and was none the worse. It is estimated that the animal traveled 300 miles on the wheel.

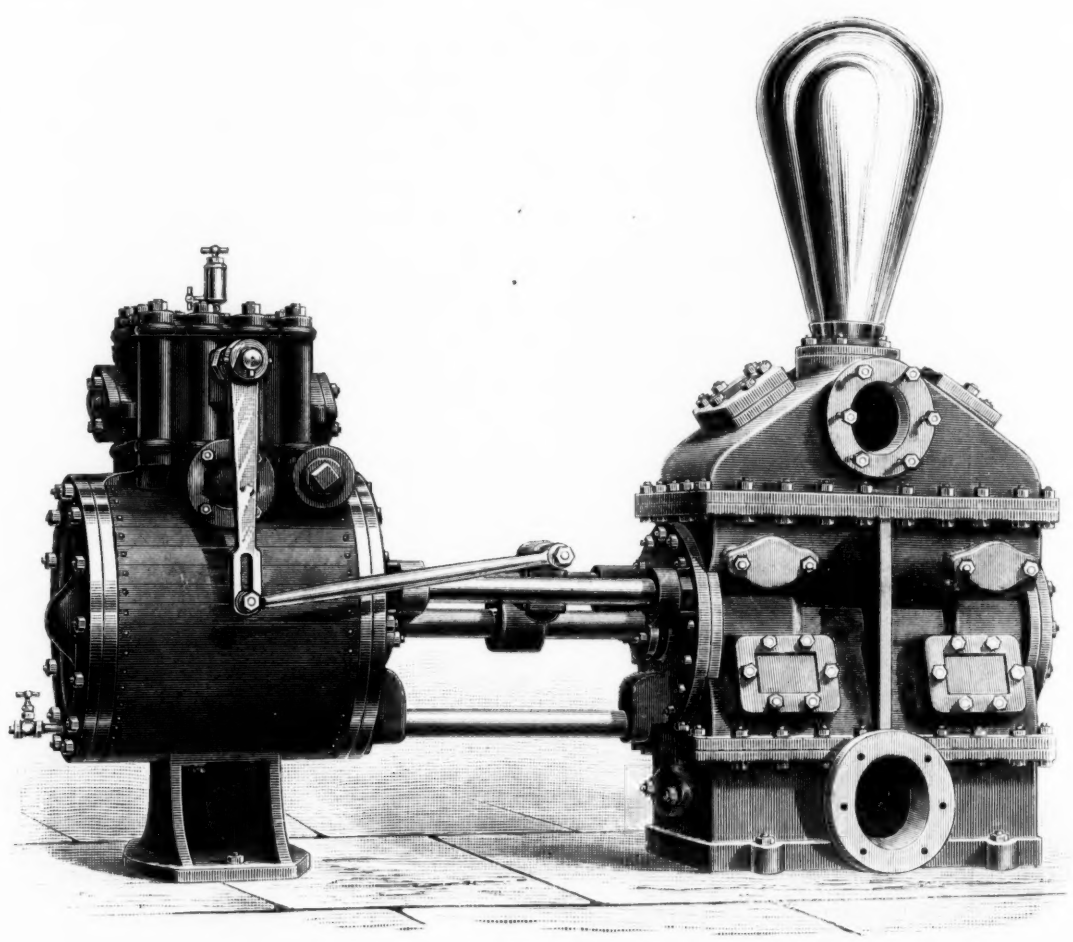
Direct-Acting Fire Pump.

A pump designed for fire service should be of simple mechanism, strongly constructed, and of sufficient mass to withstand the shock of high speed. Its water passages and valve areas should also be large, and the passages direct and unobstructed. The pump we illustrate herewith seems to possess these important qualifications, along with others that specially fit it for fire purposes. The dimensions of the one from which the engravings were made are: Diameter of steam cylinder, 20″; diameter of water cylinder, 12″; stroke, 16″.

Suction and discharge openings are provided upon both sides of the water cylinder. The suction is taken from below and the discharge above, thus providing ample and direct waterways. The water cylinder is bushed with bronze, the bushing being thick enough to admit of re-boring if it should ever be necessary. The water piston is long, of bronze, and fitted with bronze packing, but so arranged that "Tuck" or any similar packing can be substituted without any alteration.

The piston-rod of the water cylinder is of brass, and that of the steam cylinder of steel. These rods are threaded on their free ends, and held in the casting between the cylinders. This casting is provided with a cap, and is threaded to correspond with the threaded ends of the piston-rods. To release the rods it is only necessary to remove the cap, when both rods are free, and either or both pistons can be removed.

The valve motion of these pumps is simple, consisting of a plain flat main valve, a small flat auxiliary valve, and the valve driver, which is a plain cylindrical piston. The main valve is moved direct from the piston for nearly its entire travel, so that when the auxiliary valve is opened to change the stroke, the initial inertia of the main valve, and the increased friction of rest, has already been overcome, and further movement of the main slide is very easily and positively accomplished by the valve driver; no sudden starting of the valve is required of the driver, or no shock or jar introduced.



DIRECT-ACTING FIRE PUMP.

All parts of these pumps are made by the use of templates, jigs, and special tools, so that parts can be duplicated with the assurance that they will fit. As will be seen from the engraving, the arrangement is such that stuffing-boxes and other parts are easily come at, and either the steam or water cylinder may be readily removed.

The manufacturers are Guild & Garrison, Brooklyn, N. Y.

An item has been going the rounds of the press saying that thirty-five passenger locomotives on the Vandalia main line are to be equipped at once with the American Electric headlight. In answer to our inquiry, Mr. G. H. Prescott, Superintendent of Motive Power, writes us: "The item is not correct. We have one on trial, but it has not been adopted."

The management of the N. Y. C. & H. R. R. are doing a good thing in beginning the bringing together and preserving of relics of early railroading. At present the few relics that are collected are preserved in the basement of the Grand Central Depot. It is intended to collect and preserve such things belonging to the company, as will show the connection between past and present railway appliances.

Grinding Tools Again.

BY FRANK H. RICHARDS.

Mr. Hobart, in your issue of May 23, treats me in a very handsome manner, none the less so that he is, as always, entertaining. We are both of us, with many others, working for the same end to make things lively and profitable for the great and, I hope, growing audience of the AMERICAN MACHINIST.

I shall welcome with a melancholy interest, as I would any other trophy of heathendom, the photo of "the scratched post." I am learning daily—and that touching memento will enforce the lesson—that there are depths of vice and ignorance more profound than my dreams had ever fathomed. Verily one half the world knoweth not how the other half grinds.

As I understand it, Mr. Hobert acknowledges, tacitly or otherwise, the justice of most of my strictures upon his of April 18. He is kind enough to enforce my advice about grinding in front of the stone with the rest clamped *close* to it, by citing the accident which befel the chap who was grinding a tool with the rest far enough away to let the tool catch and drag down between it and the stone. If I continue to give good advice, and Mr. Hobart will thus kindly enforce it by telling the consequences of disobedience, the rising generation will be wiser and better. The rest should not only be clamped *close* to the face of the stone, but the ¾″ top is better than a wider one, as it gives more chance to tip the tool to grind clearance or give it any desired shape.

Since Tom asks me I must say that I have tried his way of grinding, and graduated from his side of the stone years ago. I have done everything that is bad in machine shop practice, but have seen and repented the error of many of my ways. Grinding on Tom's side of the stone is not the worst habit in the world, but it is bad enough. The most atrocious of all wretches is the fiend who grinds on the top of the stone without any rest at all. I never got quite so low as that.

This grindstone topic is well worth working. Which is the front of the stone? Upon which side of the stone shall we grind? Why may we not hear from many more of the contributors to the AMERICAN MACHINIST upon the subject? Mr. Hobart and I are quite pronounced in our preferences as to the two sides of the stone; who can rally the most followers, and upon whose banners shall victory roost? For myself, I say decidedly that for fast grinding, or for fine and accurate grinding, or for the best preservation of the stone, I shall stick to my own side of it.

It seems necessary and proper to keep this thing up long enough at least to answer all of Mr. Hobart's questions. I would be glad to answer many more; if only the audience will not yawn and begin to steal away; there is no danger that the performers will tire. As to the use of oil in cutting brass Mr. Hobart first advocates the practice as a general principle, and then retreats to the solitary example of drilling a ½″ hole 12″ deep in brass with a flat drill. Would I use oil in performing such an experiment? I would not drill such a hole with such a drill either with or without oil. In the older time I could have done such a job with the contrivances at hand without either grease or noise. I never was a very noisy fellow anyway. Tom said "Just think of a twist drill and you have got something to pattern after when you are grinding a thread tool or any other tool." Perhaps I was a simpleton, but I supposed when somebody wrote something that they really meant something. I didn't know how to grind "a thread tool or any other tool" after the pattern of a twist drill, but didn't like to mention it. The cutting face of the twist drill at the outside of it slants back say 15° from the perpendicular and gives a good "cut." This face angle changes at every point as we approach the center where the 15° are all lost. Now at which point shall we take our pattern?

Tom says: "The nearer you can get to the conditions a twist drill works under the more iron you can cut off with the least power and time." I took a piece of chalk and figured this statement down, giving the result to the readers of the AMERICAN MACHINIST. Perhaps I should have given this operation in detail for the satisfaction of some young readers. A 1½″ twist drill in drilling a hole 12″ deep would remove, how much metal? the amount cut off being Tom's very common sensible measure of efficiency, $1.5'' \times 1.5'' \times .7854 \times 12'' = 21.2058$ cubic in., or nearly 11 cubic in. for each lip of the drill. Now, imagining one lip of this twist drill converted into an outside lathe tool, a good old fashioned, reliable and lasting diamond point, or Tom's dandy side-tool, what would it be able to do? Taking a shaft 16½″ dia. to reduce to 15″ would give a cut of ¾″, just what the lip of the twist-drill had to cut in the case that I gave. I proceed like this: $16.5'' \times 16.5'' \times .7854 - (15'' \times 15'' \times .7854) = 213.82515 - 176.715 = 37.11015$ square in. This is the area of section that the shaft would be reduced by the cut proposed. Now, if this cut were continued for 10′, which any sensible and healthy tool would be well able to do, we would have $37.11015 \times 10'$ or $120'' = 4453.218$ cubic in. the amount of metal removed. Then, dropping the decimal, we have $4,453 \div 11 =$ (giving Tom the remainder), 404. The lathe tool cuts 404 times the quantity of metal in cubic inches, or 404 times the weight avoirdupois that the twist-drill cuts. But a little thing like that does not, and it should not, discourage Mr. Hobart. Here he says, May 23: "The twist-drill cuts 123 square inches of surface for each and every cubic inch of iron it removes, while the tool at the engine shaft cuts only 40 square inches to remove the same quantity. How's that?" Well, I should say it is as dazzlingly transparent as cimmerian midnight in the nethermost depths of a coal mine. I haven't a shadow of a glimmer of the faintest infinitesimal hint of a remote conception of the meaning of it. I have consulted other readers of the AMERICAN MACHINIST, and they all understand it alike. The penetration of each is commensurate with that of every other. They are perfectly unanimous, so that Mr. Hobart in this instance in his purpose of promoting discussion fails utterly.

"Discussion is what we are after." Mr. Hobart, or anybody else, please to give us your best, and we will be thankful for it, and we will still find enough to discuss. It is all nonsense to say that it makes no difference whether you tell the right way or the wrong way, the best way or the worst way, of doing things; that discussion will always select and establish the best. To associate with vice always in the one case and with virtue always in the other, will not result in the same robust manhood.

Discussion is nowhere more in order than in the mechanical trades. There can be no life or progress without it. The trade cannot be successfully prosecuted by implicitly following any known methods, but in constantly selecting the best of many. This is true of the individual, or of firms and corporations. It is true of the workman as of the employer. The man who knows *the* way to do a job, or *the* way to do many jobs, is a poor stick, and always behind the times. The man who doesn't know a dozen ways of doing a thing, to select the best of them today and find a better one to-morrow, will be left behind.

We need stimulus as much as we need information, and this Mr. Hobart notably supplies in some instances. He told, a week or two ago, how a fellow filed up a hexagon bolt-head in a rough and ready way in fifteen minutes. The method followed led to some discussion. The decision seemed to be that when one flat was filed the opposite one should be filed next, the two being made parallel by a pair of calipers, then the 120° gauge would have an easy time of it with the other two pairs of sides. Our boys are very likely to beat that when they get a good chance.

Singularly enough, while this discussion has been held over the dinner pails at noon, about 3 o'clock in comes a break-down job from the *Sunset* office. A short bolt—hexagon head, of course—has given out, with the edition half worked off. Boy will wait for

another. We give the job to Jake, because we know that he is always ready to begin. He has a habit of grinding his tools *after* he uses them, instead of before using them, which makes quite a difference in the long run. Then he has a way of thinking while he is working, which gives him another advantage. Well, Jake picks up a piece of iron from the blacksmith's scrap large enough and long enough to make the bolt, with enough to hold in the chuck besides. He catches it in a Horton chuck, and starts a cut the first thing with a diamond point. While the first cut is running up about $1\frac{1}{4}$", he gets his calipers set for the size of the bolt, gets a square-nosed tool and a thread tool placed right for his hand, and counts the number of threads to the inch. While his second cut is running up, which brings the bolt to the required size, he changes his gears and sets another pair of calipers to the larger diameter of the head. While taking a cut over the head he sets another pair of calipers—his first pair—to the smaller diameter of the head, and lets them stand. Then he squares down under the head and cuts the thread much as you or I would do. Next he takes an offset cutting-off tool and cuts down at the length required for the head to the smaller diameter or measure of the sides, and draws the rest and cutting-off tool back out of the way. He throws in the back gears and turns the lathe until one jaw of the three-jawed chuck is brought level at the back of the lathe; then he picks up a flat file and, holding it level, with three or four bold strokes he brings one flat side of the bolt down to the cut of the cutting-off tool, which is his gauge. He turns the lathe until the next jaw of the chuck is brought level at the front of the lathe, and files the next side of the bolt, and continues the operation until he gets around. Then he brings up the cutting-off tool and finishes cutting off the head, files the flat smooth, and the bolt is done. Fifteen minutes for the whole job, and he can do it again. He doesn't jump around as lively for the next ten minutes.

One who has run a jobbing lathe in the olden time upon bolts, set screws, nipples, plugs, washers, studs, and all the variety of what we now buy as machinists' supplies, has little patience with the later generation, but I hope to improve.

I read with pleasure Mr. Goodyear's recent "Advice to a Young Machinist." As usual, he is sound and sensible. There is now such a universal distribution of knowledge, mechanical as well as all other, that one need not be a "journeyman" to be an expert. It is almost absolutely true that in the machinist trade in America we have no trade secrets. No one anywhere need be long ignorant of the best methods in use anywhere for doing anything. Of course, one who would know all must use all available means of knowing, wherever he is. And it is safe to say that if one does not employ the means of knowing, that are around him he will be apt to go all through the land with his eyes shut. Much of current knowledge can only be got from books and periodicals. We think and speak contemptuously enough of one who cannot read, but it would be difficult to show how one who does not read is any better. I would gladly see many more young machinists interested and regular readers of the AMERICAN MACHINIST. I am sure it would profit them greatly, though they never read a word that I have to say in its columns. It does not speak well for the sense that is in the younger heads in the trade that the old heads, are the most ready to appreciate and profit by their favorite journal. I hope the modesty of the editors will not compel them to suppress this, though I know that they have a great weakness in that direction.

While we have no trade secrets, every shop still has its own line of work more or less peculiar to itself, and one familiar with that should be worth more than a stranger. Employers are a little slow to appreciate this, and it has come to be quite a fixed belief in the trade that an apprentice just out of his time is pretty sure to secure better wages by going off to a strange shop than by staying at home. I have known a great many cases, scattered through all the years of my shop connection, where young fellows have compelled appreciation by leaving the original shop.

LETTERS FROM PRACTICAL MEN.

Utilizing Steel and Iron Machine Shop Scrap.

Editor American Machinist:

I notice in the issue of May 16th an article on melting steel in an ordinary cupola. In December, 1882, we commenced melting up old scrap steel of all kinds; since then, we have melted up a large quantity. We never have had any trouble whatever, melting the steel in an ordinary cupola. We do not take the trouble to cut it up into very short pieces, but have put it into the cupola in four feet lengths, or in any shorter lengths that might be delivered to us. We mix it with car-wheel iron and with other iron for castings. In my opinion, however, to mix steel with good iron, does not improve the iron materially. We also melt up all our cast iron borings and turnings; also wrought iron borings and turnings that are too small to be worked up under hammer. We place the borings that are to be melted in very light cast iron pots, set them in the cupola and melt them down. We have melted as much as fifteen tons to a heat—taking out 93 per cent of what was put in. We find the product from these borings and turnings much more valuable than steel, to mix in small quantities with iron for castings. In the past few months we have made 149 tons of brake shoes, besides a great many other castings from these borings and turnings. We do not try to keep the wrought iron borings and turnings separate from the cast iron, but melt them all together.

I do not remember having seen any account of scrap steel having been worked up in any other way than by melting. During the past nine years we have worked up under the hammer a large quantity of scrap steel; we pile the steel on a board, the same as we would scrap iron, and take a welding heat in a reverberatory furnace. We place upon the anvil block of the steam hammer a casting having an opening through it 12"x10". This casting is about 12" thick. In the hammer-head, we have a die which fits the opening in the lower casting; when the steel is sufficiently heated we dump it into the recess in the lower casting and strike it a blow with the hammer; then another lot of heated steel is added and driven in as before; this is repeated until the opening is filled. When this is accomplished we strike it three or four smart blows, then raise the casting up and drive the ingot out. By this process the particles of steel are thoroughly welded, the ingots can then be put under the hammer and drawn out into any desired shape. We make all our locomotive guide bars, all our track tools—such as hammers, lining bars, tamping bars, spike bars, and a great many other tools from this scrap steel. We have made good drills and can make most any other tools from cast steel scrap worked up in this way. The cost of working up the scrap steel in this manner is about twenty dollars ($20) per ton.

A. J. STEVENS,
Gen. M. M. Central Pacific R. R., Sacramento, Cal.

Making Solid Castings Upon Wrought Iron.

Editor American Machinist:

Referring to the letter of Mr. Hetherington in your issue of May 23: I practiced, for several years, the following method of casting rims and hubs upon wrought iron spokes for the wagon wheels of portable engines, with entire success. A thread was cut upon each end of each spoke, as far as it was to be covered by cast iron, and these threads were covered, after removing the oil, with red lead mixed to the consistence of thin paint, with naphtha. The naphtha dried out almost immediately, and left a coating of red lead, evenly distributed, covering the bright surface and keeping it clean and dry. Without dogmatizing upon the subject, for I am by no means sure, I believe the red lead acts as a flux to promote the melting of the threads by the melted cast iron, and the firm union of the two metals. It is well known that wrought iron must be free from scale, clean and bright, to prevent blow-holes in the cast iron near it; and cutting a screw-thread is as easy as any way of making a bright surface.

The threads also present a large surface to the melted iron, with a small mass within, and reduced conduction towards the interior of the bar, so that the threads, especially near their edges, may be more easily heated up to nearly the temperature of fusion, so as to "weld," or "fuse" with the melted cast-iron.

Many experiments showed in every instance a firm union of the cast and wrought iron, and no blow-holes or other defects were ever found at their junction. It therefore seems to me extremely probable that Mr. Masters' method of casting rolls upon wrought iron shafts may answer well; but I think the red lead "paint" should be mixed with a volatile fluid like naphtha, and not with linseed oil, as the use of the word "paint" appears to imply.

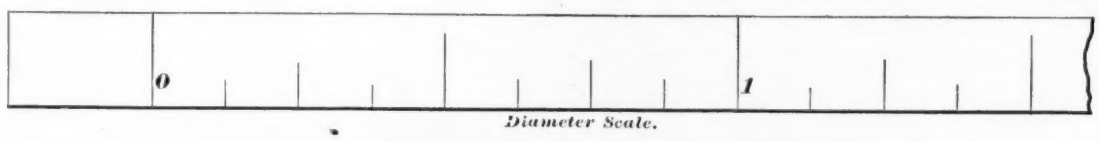
J. C. HOADLEY.

Simple Scale for Measuring Diameters.

Editor American Machinist:

I inclose sketch of a simple scale that I have found convenient in getting the diameters of pulleys, drums, etc. The principle is familiar to all, but I have never seen it used in this form before. I took a long strip of drawing paper, about one-half inch wide, and laid off spaces the entire length of it, each 3.14 inches, marking them from 0, at one end, up. Then I divided these spaces into halves, quarters, and eighths. By passing this strip around the cylinder, one can read off the diameter without any division, as is necessary with an ordinary tape. The paper strip is rather crude, and I intend to have my pocket steel tape graduated on the back in this way when I have the opportunity. It may seem like a small gain, but in certain classes of work it well pays for the trouble of making the scale.

JOHN H. BARR.
Lake Superior Iron Works, Houghton, Mich.



Diameter Scale.

Balancing Steam Engines.

Editor American Machinist:

I have read with interest a number of valuable contributions to the AMERICAN MACHINIST on balancing engines. It is a subject of considerable importance, and I am pleased to see it so pleasantly and intelligently discussed. In view of the fact that the inertia of the reciprocating mass of an engine tends to disturb the non-reciprocating parts, and if sufficient, will give to them a sailing movement which is detrimental to the working of the machine, it is important to provide a means of counteracting this ill effect.

To accomplish this end different builders use differently-proportioned counter-weights.

No general rule exists to my knowledge. Builders have experimented with differently proportioned weights, and have arrived at what are called (politely) practical conclusions, and their practice is governed accordingly. Without an attempt to depreciate the value of evidence obtained by observing the actual conduct of a machine in operation, I believe that science, in this case, is the truer guide. Science may consider all the facts, while practice is based solely on apparent results. Things are not always as they appear to be.

I am of the opinion that all engines should be balanced. The inertia of the reciprocating parts increases or decreases as the square of the rate of rotation. The centrifugal force of the counter-weights increases or decreases in exactly the same proportion. The centrifugal force of a counter-weight equaling the weight of reciprocating parts, and whose center of gravity moves in the crank pin circle (or its equal) is equal to the mean of the inertia forces of reciprocating parts taken at both ends of stroke. It follows that if a weight equaling that of the reciprocating parts be placed in the crank disk equally distant from the center of rotation and diametrically opposite the crank pin, the engine will be balanced at the ends of stroke under any speed, as nearly as can be. On account of the angular vibrations of the connecting rod, there is an inequality in the inertia forces at the front and back end, and for this reason the balance would be incomplete to a comparatively small extent. This inequality is plainly shown by the accompanying diagram, in which the shaded portion about the crank circle, x, x', x'', represents the forces of inertia which directly oppose the centrifugal forces of counter-weight. B, a and e, represent the centrifugal forces of counter-weights equaling one, two-thirds, and one-half the weights of reciprocating parts, respectively. The distribution of forces with differently proportioned counter-weights appears at a glance by referring to this figure.

It will be seen that at a point near the 90° angle, the two forces do not oppose each other in the least, and the centrifugal force of counter-weights acts in full force upon

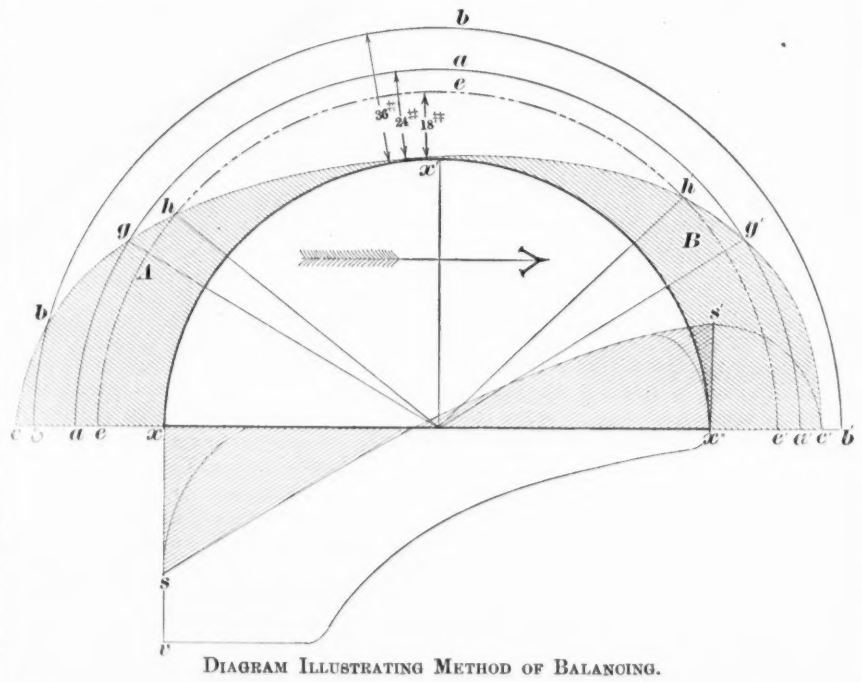


DIAGRAM ILLUSTRATING METHOD OF BALANCING.

the bearing, gravity not being considered.

It becomes a matter of choice whether we will have these forces act more powerfully in a vertical or a horizontal direction, or whether we will make them equal by making the counter-weight one-half the weight of reciprocating parts.

It appears that the best distribution would be obtained by making the counter-weight equal one-half the weight of the reciprocating parts increased by the weight of that portion of the connecting rod which may be considered as causing centrifugal effect—say one-third or one-half. As the weight of connecting rod is commonly about one-half the entire weight of reciprocating mass, then, would it not be proper to make the counter-weight from five-eighths to three-fourths the weight of reciprocating parts?

There are other considerations, however, which are of some importance. The steam pressures upon the piston although they have no effect upon the balance, yet have an effect upon the main bearing, and at high pressures and early cut-offs a very uneven one, being greatest during admission and least at termination. The counter-weight acts directly with these forces at the beginning of the stroke, and opposes them at the ending of stroke. From this it would appear that a further cutting down of the counter-weight would be advisable.

The setting of an engine, whether mounted on a boiler as the portables, running upon rails as the locomotive, vertical or horizontal upon foundations as stationary, enters largely into the questions of counter-balance and each particular service may require certain modifications. It does not disprove the fact, however, that the best general balance is secured when the counter-weight equals one-half the weight of reciprocating parts, increased by the weight of that portion of the connecting rod which may be considered as centrifugal in effect. ED. F. WILLIAMS.

Compressing Air Higher than the Steam Pressure.

Editor American Machinist:

When I read the letter from Mr. Beach, wherein he suggested the possibility of compressing the air in a Westinghouse air brake apparatus to a higher pressure than that of the steam, it seemed to me to be reasonable enough. This idea seems to be confirmed by the statement of D. Beatty, but disputed by yourself. In both your reasoning and comparison you have left out one of the elements in the problem—*the inertia of the reciprocating parts.* If the piston and rod are *heavy enough*, and the *size of the air inlet small enough*, I see no reason why almost any amount of pressure may not be hammered into the receiver, if it or the pipes do not leak. JOHN E. SWEET.

Casting Rolls on Wrought Iron.

Editor American Machinist:

In the interesting discussion now going on through your journal, on casting rolls on a shaft, there is one point entirely overlooked by both Mr. Masters and Mr. Hetherington; that is, in not telling why they regard their respective plans as the best. Perhaps brevity would not admit it.

On reading Mr. Hetherington's criticism on Mr. Masters' foreign substance, one is led to the conclusion that he is not aware of the real object of using red lead.

Lead has been used for a great many years on work of this class; and how often you will see a moulder using it, without knowing why he does so. If you ask him, he will generally say that it makes the iron stick better. In some shops chalk is used instead of lead, while in others the tinning process is preferred. By having a thread cut on the shaft, as Mr. Masters recommends, the cast iron will more easily melt it than if it was a plain surface. The falling of the iron on the thread, from the gate directly over it, must melt the sharp corners very quickly, thereby forming a union of both metals, consequently a solid mass with no chance for the shaft to screw itself out of the casting, as Mr. Hetherington imagined. The red lead is employed to prevent dampness and rust from collecting on the shaft, which would produce a bad casting by causing the molten iron to "kick" from the shaft.

Now, as there are more ways of killing a cat than choking it with butter, so are there more ways of successfully casting a roll on a shaft, than having the shaft threaded, and Mr. Hetherington's is one of them. As a substitute for the thread, he has employed heat, which not only takes the place of the thread, but of the lead as well, as it expels all rust and moisture. The shaft being thoroughly charged with heat when the molten iron strikes it, it must instantly commence "burning," and cause that union which he calls welding; and it is my opinion, that unless that union does take place, it will never be entirely free from vibration.

From personal experience, I can state that pouring the mould while the wrought iron is hot has always given the best results, but as heating would be impracticable on a large class of such work, it must be cast cold. It is then we find the benefit of Mr. Masters' plan. But instead of the lead I would recommend tinning wherever it is convenient, as I have known it to give better results, especially on small castings.

M. E. CHANIC.

Producing Strong Castings from Scrap Steel.

Editor American Machinist:

In your last issue, May 30, 1885, I write: "There still remains one thing to be done, and that is to have the melted steel produce, *direct from a cupola*, castings somewhere near as strong as the scrap steel was before being melted." The word "cupola" should have been followed with *air furnace* and *crucible*—two things which might be arranged so as to melt "scrap steel" as well as in a cupola, and thereby overcome the injurious oxidation steel receives when melted in a cupola.

THOMAS D. WEST.

"Driver Brakes."

Editor American Machinist:

In a recent issue of an alleged railroad journal, I notice an article advocating the doing away with driver brakes, because they were hard on crank-pin brasses, etc. The plan advocated was to fix a cone on a spline to the back-driving axle, which was to be forced into a stationary female cone bolted to the engine frame. When these cones were forced together, the friction between them was to furnish the retarding force, and thus not injure the crank-pin brasses. Upon first reading it, I thought it was a joke, but, after a second perusal, I saw the editor of the journal referred to was in dead earn est. What bothers me is how he proposes to renew these cones as fast as the friction will rip their surfaces off or pull the whole rigging down, unless he carried a foundry and machine shop along on the tender for this purpose. This is only a trifle more absurd than that eighteen-hour engine.

DRAFTSMAN.

A Caliper That is Not Patented.

Editor American Machinist:

The desire to possess something better in the line of outside calipers than the ordinary spring, or the plain, home-made article, led me to design and make the one shown, which may have enough novelty to interest some of your many readers: By referring to the cut, it will be seen that the body, or case of the tool is a part of a circle, having within it the movable leg, on the outer edge of which are cut V-shaped teeth (on the principle of a worm wheel), into which the worm engages and moves the leg in either direction. The small screw above the worm is for the purpose of preventing the caliper from being moved after setting it to the size desired. I have had it in use for some time, and find it stiff and reliable for ordinary work; also very convenient to carry in the pocket to take a size outside the shop.

F. H. TRACY.

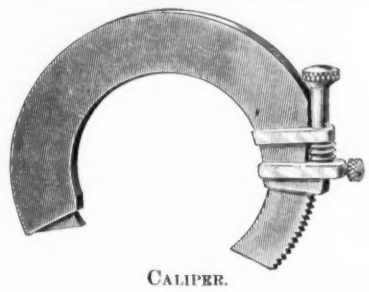
Poughkeepsie, N. Y.

Melting Steel Scrap.

Editor American Machinist:

I have been thinking over the article by E. L. Black, in your issue of May 16, on the melting of steel scrap, and would, if desirous of using it, use a low pressure of blast. I have found that in melting we can get a better quality of metal by doing so. By increased speed in our fans or blowers we gain time, but sacrifice quality.

We must not expect a uniform quality of steel or iron from an indiscriminate scrap

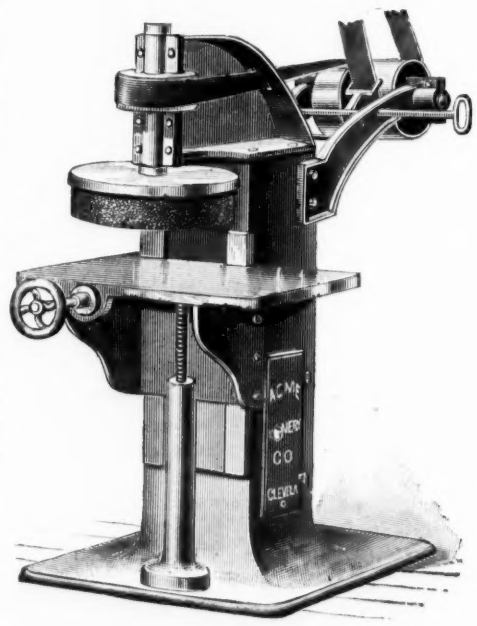


CALIPER.

pile. It is necessary to sort scrap into bins and number according to quality, then charge your metal by card, directing how much of each kind to use and how to put it in. If we are unfortunate in having conceited melters, there are others to be had, even if we have to break them in ourselves. After doing this once, the necessity hardly ever arises again.

Further, I have found that by using a low pressure of blast there was no need to box small or fine scrap. I have also found that we foundrymen change the quality of our mixtures more than we are aware by following the common custom of cooling our dumps with water every night, and putting the remnants in our next heat without paying sufficient attention to the change produced by this process of sudden cooling, the effect of which is so well known to mechanics. Let our mixtures be never so carefully made, this will make spots in our castings not warranted by the rest of our mixture.

I believe the small casting of the future is to be steel, perhaps the large also, and feel



ACME SURFACE GRINDER.

anxious to learn by comparison of ideas and experiments all I can. Hoping to hear more on this subject, I wait patiently for more light. THOS. WALLS.

Rockford, Ill.

Oiling Locomotive Valve Motion.

Editor American Machinist:

If I were a master mechanic, I would give J. A. Hill's "Improved Oil-Holes for Locomotive Motion," mentioned in the AMERICAN MACHINIST of May 23, a trial, if he would furnish bonds and agree to atone for all the cuss words placed by the recording angel against brother engineers, while trying to get at them under the various circumstances attending oiling on the road.

Trace the "accidents" attending these parts to their source, and you will find they have been neglected when oiling around. A drop or two every fifty or seventy miles, placed where it belongs, will carry the links safely where several drops on the ground or none at all will give them trouble. For overcoming the extra strain from cut or imperfectly oiled valves, have your valves faced and keep them properly oiled. With links in good order, there should not much oil waste past the block; with economical oiling and with link working in forward motion, its tendency would be to go forward as much as backward.

For improving oil holes on links, small brass cups set in all the holes, with open holes through a top screwing on, will be found as reliable as anything. A little wool in the bottom will strain the oil, hold the dust and grit from the bearing, and reserve oil enough for gradual feeding and a long run; besides, the cups catch the oil from oiling can, that usually goes on the ground. If the cost of these cups can be paid in less amount of oil used and better working machinery, they will prove the most practical.

Brainerd, Minn. J. E. PHELAN,
Locomotive Engineer.

Casting Rolls on Wrought Iron Shafts.

Editor American Machinist:

Mr. Hetherington, in his article in your last issue is quite right about keeping a wrought shaft free from all foreign substances when casting a roll on it. He also seems to doubt the result of cutting a thread on a shaft to hold the roll in position. Ask him to cut a right-hand thread on one end of the shaft, and a left-hand thread on the other, and then send us word how far he can move the shaft endways by twisting it. CHIP.

Air-Brake Question.

Editor American Machinist:

I notice in your issue of May 23 a reply by Mr. Beatty to Mr. Beach's question in reference to the possibility of an air-brake pump on a locomotive pumping air into reservoir at a greater pressure than that of boiler, both cylinders being equal.

Although not familiar with the practical working of the air pump, I think it is possible to pump up 80, 90 or 100 pounds of air with 60 pounds steam acting on piston equal in area to air piston, as the mean effective pressure, taking steam full stroke, may be 60, while the mean effective pressure on an air pump, pumping into reservoir at 90, may be much less, as it begins its stroke with 0 and ends at 90.

I am sure it would be possible if the air pump had the advantage of a fly-wheel, and I think the weight of the pistons on downward stroke, added to the impetus gained at beginning of stroke when air pressure is low, would cause the pressure in air reservoir to exceed that in boiler. F. A. R.

Acme Surface Grinder.

We illustrate with this a surface grinding machine, made by the Acme Machinery Company, Cleveland, Ohio. The engraving shows the general construction of the machine. The emery wheel is in the form of an annulus, 16″ diameter, 4″ deep and 1″ thick, secured to a cast-iron plate on a vertical steel spindle.

The work to be ground can be held in any suitable chuck or holder, and is passed under the wheel by hand movement.

The table is 16″×24″, and is raised or lowered by the hand wheel shown between a position 12″ below wheel to as high as desired.

The manufacturers recommend this as a very economical machine in all shops for grinding flat surfaces, saving filing and scraping. Also for dies of all kinds, cutters or knives, either flat or beveled, for work sprung in case-hardening and tempering, and for all kinds of special or general work.

The extreme height of machine is five feet; countershaft attached as shown.

W. A. Walden, division master mechanic of the East Tennessee, Virginia & Georgia Railroad, writes us: "We are rebuilding and remodeling all our old locomotives, putting on extended fronts, etc. Have six in shop at present undergoing repairs."

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NEW YORK, JUNE 6, 1885.

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Progress in Foundry Practice.

The articles which have recently appeared in the AMERICAN MACHINIST on the subject of melting steel in an ordinary foundry cupola have attracted a good deal of attention, and led to interesting discussion. In this issue we publish a letter from A. J. Stevens, general master mechanic of the Central Pacific Railroad, on the melting of steel scrap and cast and wrought-iron borings, and the utilization of the melted metal in various kinds of castings. We call especial attention to what he writes, as from an economical point—fortifying, amplifying and adding to what we have before published on the subject, we think the letter a very valuable one. Large quantities of such material as he has satisfactorily dealt with in the cupola are permitted to accumulate around railroad and other machine shops and foundries, and thousands of dollars could be saved by utilizing it; hence, any information detailing how this can be done is important. Besides this letter, communications from others on the same subject will be found in this issue.

We also present a paper on making castings direct from wrought iron, read before the Iron and Steel Institute of England, which is deserving of more than ordinary notice. If the writer of this paper accomplishes what he claims—viz.: the production of castings from wrought iron, having all the desirable and valuable qualities of forgings—it is certainly an important matter.

In all this—that is, in melting wrought iron and steel—there is nothing, in a general sense, that is new. It has been done, mostly in an experimental way, before, but the difficulties believed to be in the way of its accomplishment have prevented any commercial value being realized. The information that our correspondents give is entirely of a practical kind, detailing processes and operations of commercial value. It is not theory, but actual and successful practice.

On other foundry matters we publish a letter from the well-known expert and practical mechanic, J. C. Hoadley, and letters from others in charge of foundry operations—experienced, practical men. Until within a few years comparatively little has been written on foundry matters by those who knew from experience what they were writing about. But all this is being changed, and these things are receiving the attention due their importance. It is apparent that much that has heretofore been practically waste material around railroad and machine shops will in the future be turned to account in the foundry.

Railroad Passes and Railroad Advertising.

The Railway Register, of St. Louis, published an interesting correspondence between the manager of that journal and the general passenger agent of the Ohio & Mississippi Railroad, in which the favors of granting free passes to newspapers and of advertising rail routes in railroad journals are treated in a somewhat racy style. The correspondence opens by a letter from the passenger agent to the publisher, asking him to send an extra copy of his paper each week. The publisher replies, the next day, with a bill for one year's subscription. This brings a letter from "the party of the first part" to the controversy, saying: "In view of the fact that you receive two monthly passes regularly from this office, I thought it was not asking too much when I requested an extra copy of your paper, and anticipated it would be gratuitous," and inviting him to discontinue the extra copy if he will not send it free. Following this is an epistle from the publisher, declaring that: "Upwards of one hundred of the leading railways of this country have enough confidence in this newspaper to trust the manager and editor each with an 'annual,' for which they require no bonds. Among these are the roads on both sides of the Ohio & Mississippi Railroad. The issue of these passes are considered courtesies, due to us as publishers of an established railroad journal." He returns "last month's tickets," and says he wishes to use no more, as the "tickets were issued under such restrictions as to exclude us from using them." It appears that the passes, or "tickets," were monthly instead of annual. The ticket agent replies that the complainant has been supplied the same as other papers with free passes. Then follows a letter from the manager of the *Register*, which lets a large feline out of the sack. We quote the most interesting part of it:

You send out a monthly ticket to editors, good for a limited number of rides, as *payment* for services. You show this by requiring a receipt of the user for a ride of the value of so much cash, whenever the pass is used.

* * * * * * *

We consider passes only as courtesies, for which the givers ask no return, although one is made.

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It is a small evasion to say that your rule is inflexible, because no rules are without exceptions. This paper is generally treated as an exception, and whatever roads may do with the newspapers on their lines, they, as a rule, send complimentary annuals to the manager and editor of this paper. They believe it pays in many ways.

You do not believe this. You would suppress all railway journals if you could. You will not advertise in them, because you do not see that by so doing you will influence travel over your line. You cannot understand how valuable an advocate a strong railway journal can be in these days of hatred and malice towards railway corporations.

The next letter of the series is from the general ticket agent, and we quote enough of it to show how he regards such claims for advertising and annual passes:

You have asked me to advertise the advantages of this road in your paper. I could not consistently do this, for the reason that I did not think the advertisement would influence travel over this road, and, if I remember correctly, I told you why I based my opinion on the fact that your paper circulated almost exclusively among railroad men, and that an advertisement in that direction would not prove beneficial. I have not the time to refer to my letter book, but have no doubt a perusal of the letter will show the reasons to be about as stated. I, of course, do not take into consideration "how valuable an advocate a strong railway journal can be in these days of hatred and malice towards railway corporations," as that is not a part of my business or duty. Such a claim may be valid. If so, the laborer is worthy of his hire, and should be settled for by voucher and the nature of the services clearly stated in the voucher by the officer who represents such interest, and not be covered in advertising account, where it does not belong.

I do not advertise in any paper for its good-will. I only advertise for the purpose of securing passenger business, and my experience justifies me in saying that no paper of any great influence demands an advertisement under the penalty of scurrilous attacks unless it is forthcoming. You assume that the press is entitled to the courtesies of a pass over railroads. I do not understand a newspaper man is entitled to any different treatment than that accorded any other gentlemen.

The above extracts from the correspondence of the two men show the policy of the journal mentioned, and what we cannot but regard as a just arraignment of the same by the railroad official. Why should newspaper men be entitled to a free ride over a railroad any more than any other gentlemen? If a newspaper furnishes any service to a road, the exact nature of that service should be mentioned in a bill or voucher, and it should receive payment direct. The public, who patronize both railroads and newspapers, should know by some distinguishing mark what part of the newspaper they read is railroad advertisment paid by free passes or otherwise. The publisher of the *Register* admits that a return is made for the passes received, but evidently it is not by furnishing free subscriptions, for he sends a bill for an extra copy ordered to be sent regularly to the ticket agent, from whom he received two free passes. Nor does the return seem to be in regular space advertising, for he appears hungry for some such patronage from the agent addressed.

If there is no return for the free passes furnished to newspaper men, the general public, who pay for tickets, must pay a rate high enough to cover the cost of transporting those who are carried free. This is not just to those who pay.

Advertising in any paper should be placed upon its proper basis, viz., the direct value of the space occupied, and should not be given as a bonus for advocating certain interests which the advertiser wants defended. No independent newspaper can afford to accept free passes or to solicit advertising because of advocating special interests.

The mining resources of this country are varied and wonderful. A few weeks ago a reported valuable soap mine was discovered, now information about a remarkable ink mine in Georgia is made public. According to a Texas paper, a natural ink is found at the bottom of a copper mine at the foot of the Kennesaw mountain. "It is a peculiar liquid of a deep wine color," says our authority, "and when a few drops of nut gall are added it turns jet black and at once becomes ink of the best quality. It neither fades, freezes nor corrodes." Next to the discovery of a whiskey spring this is important.

Artificial refrigeration where quite low temperature is required, as in some of the processes of the manufacture of mineral oils, and in other industries, has almost entirely superseded the use of ice for that purpose. This is not mainly because it is cheaper, but because it is much better for the purpose. In such industries manufacturers would not return to the use of ice if it were furnished to them ready to use free of charge. The growing popularity of artificial refrigeration has stimulated invention, and recent improvements have greatly simplified and cheapened the process.

English trade journals are discussing at length, editorially, and through correspondence, the reason why American manufacturers hold the trade in axes in Australia. It is an old subject, but the reason is one that manufacturers striving for foreign trade should never lose sight of. Briefly, it is because American manufacturers were willing to furnish the kind of goods wanted, while English manufacturers insisted that they knew better what the colonists wanted than the men who used the axes.

One of the best signs of business improvement is an advancement of wages. During the last two weeks several manufactories have advanced the wages of their employes. When it is made evident that the cutting down of wages has stopped, and an upward tendency is visible, a solid revival of industries may be expected.

For the year ending June 30, 1882, the number of immigrants to this country reached a total of 788,992. For the year ending June 30, 1885, the number, from present appearances, will be but little more than half of that. Periods of prosperity and depression in this country are very plainly marked by the increase and decrease of immigration.

Silk culture, which was tried and abandoned in the South some years ago, it is said, is to be revived with good prospects of success.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(172) G B., Reading, Pa., asks: Is there anything in print about the manufacture of wrought iron pipe and boiler tubes? A. We know of nothing that would help to a knowledge of their manufacture.

(173) Student, Syracuse, N. Y., asks: What is the temperature and weight per cubic foot of steam at 100, 200 and 300 pounds pressure? A.—According to Nystrom: Temperatures, 329.9°, 382.6° and 416.5°; weight per cubic foot, 0.2316 lb., 0.4517 lb., and 0.6681 lb. These are for pressures above vacuum.

(174) B., Vineland, N. J., asks: What will be the linear expansion of a rod of copper,

and one of silver, three feet long, raised to a temperature at which steel will harden? *A.*—Assuming you raise the temperature 1,000°, the expansion of the two bars will be about 35-100 inch and 4-10 inch. respectively.

(175) **C. Y., Eau Clare, Wis., writes:** I have a 3″x5″ vertical engine. How large a boat, boiler and screw can I use it with to make headway against the current in the river here? *A.*—Boat, 25′ long, 5′ 8″ beam; boiler, 28″ diameter and 46″ high; screw, 26″ diameter, 30″ pitch. We do not know what the current is in the river. Such a boat should make 7 miles an hour in slack water.

(176) **B., New York City, asks:** In an engine fitted with a slide valve, cutting off at half stroke, starting with the crank on either center, how many motions has the slide valve while the crank is making one revolution? *A.*—We infer this is entirely a question of definition. The slide valve, as well as the piston of an ordinary steam engine has only one motion during one or one hundred revolutions, viz: a *reciprocating* motion.

(177) **L. A., ——, California, asks:** 1. If a boiler is filled with steam of, say, 100 pounds pressure, no water being present, and heat is applied, will the pressure be increased, or only the temperature? *A.*—Steam superheated under the conditions named will show increase of both temperature and pressure. 2. I am told that iron is strengthened by heat up to 600° F. Is this true? *A.*—It is generally conceded that the cohesive strength of iron is increased by heating up to between 500 and 600 degrees.

(178) **Radiate, Boston, Mass., asks:** 1. With steam upon one side of an iron plate, or pipe, and air on the other side, how many units of heat will be radiated per hour per square foot of radiating surface and per degree difference of temperature, and does the rate of difference increase directly with the difference in the temperature? *A.*—It is not known beyond dispute. Undoubtedly the difference does not increase exactly with the temperature, but what the variation is, is not known with certainty. The late Robert Briggs (Briggs on Steam Heating), assumed that, within temperatures ordinarily used in steam heating, each 100 feet of radiating surface would give off 3 units of heat per minute for each degree difference in temperature. 2. Please give tables showing cubic feet of space warmed by one horse-power steam in different buildings, such as stores, cotton mills, machine shops, foundries, etc. *A.*—We cannot give tables that would be of any value. Many things must be taken into consideration; any individual case must be decided from knowledge of all the attending circumstances.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Edw. Sears, wood engraver, 48 Beekman, St., N.Y

Katzenstein metallic packing, 169 Christopher st, NY.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

The best upright hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Tools for amateur and foot-power lathes. Send for illustrations. Hartford Tool Co., Hartford, Ct.

Light fine interchangeable mach'y to order. Foot lathe catalogue for stamp. E. O. Chase, Newark, N.J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Split pulleys cheaper than plain ones. Trial orders solicited. York & Benton, Cleveland, Ohio.

Consulting Engineer and Mechanical expert, C. C. Hill, 84 Market street, Chicago, Ill.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

The outline ("wax process") engravings shown in the AM. MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Farley's Reference Directory of the Machinists, Iron, Steel, and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-Taught," $4. Books for workmen Joshua Rose, Box 3306, New York City.

Heavy second-hand 18 x 36 engine for sale. Send to Frick Co., Waynesboro, Pa., for prices and a list of second-hand engines and boilers, all kinds, and in good order—prices low.

Locomotive Engine Running and Management. By Angus Sinclair. Price $2. An excellent book for men interested in steam engineering, valve setting, designing valve motion, the care of the Westinghouse brake, etc. Published by John Wiley & Sons, 15 Astor Place, N. Y.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo. edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies.

Useful Information for Steam Users—A 100-page pamphlet, on the care and management of the steam engine and boiler, with hints and rules for engineers and firemen. Every engineer should have this book. Send 25c. in P. O. stamps to the J. N. Mills Publishing Company, 165 Broadway, N. Y.

MANUFACTURES

Roberts, Winter & Co., Kingston, Tenn., contemplate erecting a foundry.

Gebhart & Esterbrook, East Saginaw, Mich, will erect a new planing mill.

It is stated that J. K. Miller and others will establish a rolling mill at Rome, Ga.

The Buckley Buggy Co, Columbus, Ohio, are preparing to build a six-story factory.

Cedartown, Ga., is trying to make arrangements for the establishment of a rolling mill.

Moses Levey, Ripley, Me., will fit up a new woodworking establishment with machinery

The Rensselaer Mfg. Co., Lansingburg, N. Y., are about to erect a factory and rolling mill.

Shaw & Co., of Easton, Me., will erect a machine and blacksmith shop the coming summer.

M. J. Murphy & Co., furniture manufacturers, Detroit, Mich, will build two new buildings.

Mr. Mosher has started a machine shop corner Market Street and Pacific Avenue, Dallas, Texas.

Capt. S C. Speers, Belle Vernon, Pa., will build a new planing mill and equip with new machinery.

S. H. Larue is organizing a company at Reading, Pa., to manufacture stoves under his various patents.

The Montgomery Oil Works, Montgomery, Ala., will build a 50-ton cotton seed oil mill in Mobile, Ala.

The S. C. Bent Wood Furniture Co., lately organized at Columbia, S. C, will build a furniture factory.

McKeesport, Pa., has organized a Business-men's Committee to induce manufacturers to locate in that town.

O. G. Vanderhoof, of Knoxville, Tenn., reports that a $25,000 tool factory is soon to be established in that city.

James Jenks & Co., of Detroit, Mich, have recently made a shipment of their duplex injectors to Germany.

It is reported that the Russian Government has ordered 50 steam pumps from C. M. Miller & Co., Canton, Ohio.

A milling machinery manufactory, to employ 800 hands, is one of the new enterprises talked of at Jackson, Mich.

It is reported that O. M. Stone, of Augusta, Ga., contemplates building a factory to manufacture gins in Athens, Ga.

T. M. Nagle, Erie, Pa., is about to build a new boiler shop, to be fitted with new machinery. Estimated cost, $20,000.

The Laughlin Nail Company, of Wheeling, W. Va., have contracted for a Bessemer plant with a capacity of 300 tons per day.

A stock company will be organized soon for the purpose of starting a canning factory in Shelby, Mich, with a capital of $10,000.

A. G. Hill, Florence, Mass., will erect a new factory to make a patent cash transmitter for use in mercantile establishments.

The Manchester Cotton Mills Company, Manchester, N. C., will overhaul and repair their machinery and build some new shops.

F. Scholes, 126 Bedford Avenue, Brooklyn, N. Y., will start a small machine shop near his residence. He will put in an engine and boiler.

The Boston Woven Hose Company, 234 Devonshire Street, Boston, Mass., will erect new works in Cambridgeport and fit up with new machinery.

F.C. Cannon, 45 Orange Street, New Haven, Conn., will fit up with new machinery to make cast iron pulleys with Blevney's patent self-centering hubs.

The Anniston Car Works, Anniston, Ala., will issue $40,000 of stocks and bonds, with a view to enlarging these works and putting them in full operation.

The Northwestern Screw Company, of Chicago, have formally organized by the election of James J. Holsworth as President, and E. H. Holley as Treasurer.

Crossland, Long & Thomas, of New Haven, Pa., have formed a company to build and operate an iron foundry. Steam power will be used. Estimated outlay, $8,000.

J. W. Clark, Master Mechanic of the Cape Fear & Yadkin Valley Railroad, writes us: "We are building some box cars, but have no idea of adding to our shops at present."

Among recent sales of the Rochester Machine Tool Works are two iron planers to the Harris Iron Works, Buffalo, N. Y., who also had two planers of the same company in 1884.

Business is improving with the Straight Line Engine Company, Syracuse, N. Y. They are receiving foreign orders, as well as an increase of orders from different parts of this country.

John Bisset, Master of Machinery of the Wilmington & Weldon Railroad, writes us that his road does not contemplate building any shops at Rocky Mount, N. C., despite the report to the contrary.

At New Castle, Pa., nearly all the $25,000 stock necessary to cause the removal of the North Fairfield (O.) Plow Works has been raised, the Keystone Foundry has been purchased, and a building 85x40 will be erected.

James P. Witherow & Co., have contracted to build a new steel plant for the Cedar Point Iron and Steel Works, at Port Henry, N. Y. It is proposed to convert steel into ingots directly from the blast furnace.

Pocket-knife making is practically dead in Naugautuck, Conn. A few years ago four factories were running to their fullest capacity, giving employment to hundreds of men. Not a single knife is being made now.

Last week we received a call from H. T. Roffe, Superintendent of the Georgia Machine Company, of Atlanta. That company employs 37 hands, has just brought out a new lath machine, a gang saw, and a cutting-off saw.

Phillips and Garbett, it is reported, have purchased a site in Elberton, Ga., on which to erect a foundry and machine shop. Another dispatch gives the firm name as Phillips & Lombard.—*Baltimore Manufacturers' Record.*

John C. Froelich & Co., of Baltimore, have leased the Chesapeake Marine Railway of the same city, and will erect on the adjacent ground a machine shop 69x100 feet, boiler shop 40x100, piers, heavy lifting machinery, etc.

The Manhattan Hardware Company, of Reading, Pa., have determined to sell their present buildings, owing to lack of room, but have not yet decided as to their future movements. Scranton has made them an offer if they will locate in that city.

Crane Brothers Manufacturing Company will erect at once a three-story and basement brick factory on Jefferson Street, immediately south of Van Buren. The factory will front 180 feet, and have a depth of 60 feet.—*Chicago Industrial World.*

G. S. Woolman, 116 Fulton Street, New York, has issued a catalogue of interest to draftsmen, containing descriptions of drawing instruments and materials. He has also issued a pamphlet descriptive of Higgins' liquid drawing ink, for which he is agent.

Senator Cameron, of Pennsylvania, Senator Mahone, of Virginia, and others have organized the Roanoke Navigation and Water Power Company at Petersburg, Va, to develop water power for factories. S. P. Arrington, of Petersburg, is Secretary. Capital, $500,000.

H. N. Burford, Master Mechanic of the Memphis & Charleston Railroad, writes us that it has not yet been decided where the new shops of that road will be built. Both Tuscumbia and Memphis have been talked of for the location. They have temporary shops erected at Memphis.

Warner & Swasey, Cleveland, Ohio, write us: We have been increasing our force, and are now working more men than ever before. The demand for our brass working tools and screw machines is increasing, but our orders are generally for small rather than large lots of machines.

The Yale & Towne Mfg. Co., of Stamford, Conn., have made a contract under which they will hereafter conduct the manufacture and sale of the Hawes adjustable horse-shoe. The inventor, Dr. A. C. Hawes, of Noroton, Conn., has been introducing the shoe with, so far, very satisfactory results.

The Hendey Machine Company, Torrington, Conn., have issued a new illustrated catalogue of machinists' tools and special machinery, as manufactured by them. Good engravings, clear print, and tasteful arrangement, coupled with intelligible information of each machine, make the catalogue one to be preserved.

Dean Bros.' Steam Pump Works, Indianapolis, Ind., are running full time. Among recent notable orders are six pumps for Schmidt's Brewery, Indianapolis; fifteen special distillery pumps for Illinois and Kentucky distilleries, and one large duplex pump for water supply at Michigan State public school, Coldwater.

The Russell Paper Company, of Bellows Falls, Vt., are preparing another mill in which they will place the largest paper machine in the United States. It is to be a Harper-Fourdrinier machine over 140 feet long. The drive-rolls are 54 inches in diameter and over 90 inches long. This machine is designed for newspaper, and makes three sheets at one time. It will cost about $20,000.

The Gordon & Maxwell Company, Hamilton, O., have issued a new illustrated catalogue of steam pumping machinery, and a new price-list. It has 85 pages, and the engravings are large. Detail cuts are shown wherever necessary. Descriptions are clear, and a well arranged index makes it handy for reference. Much useful information about steam pumps in general is included in the catalogue.

Sebastian May & Co, manufacturers of foot and power lathes, drill presses and light machinists' tools, Cincinnati, Ohio, write us: For want of room in our old quarters we were compelled to move to a larger building, Nos 169 and 171 West 2nd Street, where, having added considerable new machinery, we will be better prepared than ever to keep up with the constantly increasing demand for our tools, and expect shortly to bring out several new machines.

The Edison Machine Works, New York City, in addition to their regular work, are contracting for other kinds of machinery. At present they are building a large number of hand rock drills, and are also building large vacuum pumps. They are manufacturing electric motors from one-half to three horse power, and are completing the electric motors for trial on the elevated roads.

The Charleston Iron Fence and Machine Company, previously reported as being worked up, has been incorporated in Charleston, W. Va., by W. K. Burton, Mt. Sterling, Ky., John L. Winkler, B. R. Winkler, G. R. Jacobs, Frank Woodman and D. C. Gallagher, of Charleston, W. Va., to build foundry and machine shop and manufacture iron fence. Capital stock, $4,500.—*Baltimore Manufacturers' Record.*

David Boyle, 521 W. Monroe Street, Chicago, has within the past month finished and put in satisfactory operation the following machines: One 5-ton ice machine, at Pine Bluff, Ark; one 10-ton ice machine at Portland, Oregon; One 30-ton machine at Covington, Ky.; one 20-ton refrigerating machine for N. K. Fairbank & Co., Chicago, making altogether 117 of his machines in regular operation. Mr. Boyle is now having his machines built with the McBullock Mfg. Co., Chicago.

Guild & Garrison, Brooklyn, N. Y., are doing a fair business in their general line of steam pumps and pumping machinery, which includes everything used for moving water or air. They have introduced the interchangeable system in the manufacture of all machinery, providing templates and jigs for every piece and hole. In addition to pumping machinery they build engines, in which they have introduced several improvements, for the ammonia process of artificial cooling.

On April 4 the Consolidated Safety Valve Company, of Boston, owners of the Richardson patents, filed a bill in the United States Circuit Court, in Chicago, for an injunction and accounting against the Union Brass Manufacturing Company, of Chicago. Recently a final decree was entered by Judge Blodgett by agreement of the parties awarding the complainants the sum of $10,000 as profits and damages on account of the infringement by the defendants of the Richardson patents of 1866 and 1869. An injunction was also granted against the Union Brass Manufacturing Company on the Richardson letters patent of 1869.

The Eclipse Wind Engine Co., Beloit, Wis., have purchased the wagon works plant in that city, and will remove thereto as soon as possible. The *Beloit Free Press* says: "It has long been known that, while the Eclipse Works cover an area of five acres of land, they have been hampered for room, and already occupy all of the available property in their locality, and that it was only a matter of time before the company would be compelled to seek more commodious quarters." They have now about 15 acres of ground, and will build a large brick foundry this summer. Our contributor, Robert E. Masters, has recently become foreman of the foundry.

E. W. McKenna, Superintendent of the Jeffersonville, Madison & Indianapolis Railroad, writes us as follows in answer to an inquiry about a report that they were to build shops to cost $50,000; "The report you have heard is only partially true; we expect to make some improvements in our yard at Louisville, which, together with the construction of a ten-stall engine house, will cost in the neighborhood of $50,000. The engine house will be a frame building with ten stalls, with a small shop for doing light repairs. The machine tools will comprise a lathe, planer, drill press and grindstone. There will be a blacksmith shop running from two to four fires."

George B. Grant, 66 Beverly Street, Boston, Mass., has issued catalogue "A," of standard gear wheels, light pulleys and hangers, calculating machines, water motors, etc. Printed on the cover is a sample plate of gear teeth and rim sections, the impression being from real cut teeth of wheels. This plate gives a very clear idea of the actual size of each diametral pitch. The price-list contains not only prices for goods in metal, but prices for drawings of gear teeth single or in interchangeable sets, also the cost of engineering advice in relation to gearing, etc. The catalogue, in addition to special matter, contains useful tables and matter of general interest. It is sent free to any machine shop or manufacturing concern.

Fayette Brown, receiver of Brown, Bonnell & Co., iron manufacturers, Youngstown, Ohio, reports to the creditors earnings of $247,000 in 22 months and a week up to January 1, 1885. "These earnings have been made in the face of continued decline in prices—from February 21, 1883, to January 1, 1885—of $10, $15, $22 and $24 per net ton, respectively, on the four principal kinds of finished products turned out. In addition to this shrinkage the profits have been affected and the business embarrassed by the uncertainty as to the length of time the property would remain in the hands of a receiver. Considering these difficulties and the small working capital—about $178,000 in material, etc., as above shown—the trade of the company has been pretty well retained, and the profits as large as could reasonably be expected. Since the first of February there has been a very considerable increase in our sales, the daily shipments averaging from 150 to 200 tons of finished product." After making the favorable report mentioned above, Mr. Brown notified the workmen that unless they will accept a reduction of wages he will close the mill.

A new company has been formed at Jackson Mich., known as the George F. Smith Dust Collector Company, to manufacture the Kirk & Fender dust collectors. The officers of the company are: President, Geo. F. Smith; Vice President, Alva Kirk; Secretary and Treasurer, W. J. Fender.

Machinists' Supplies and Iron.

NEW YORK, May 21, 1885.

The supply business remains unchanged, without much prospect of immediate increased activity.

Iron—In American pig sales are unsatisfactory, with no indications of change. For standard brands we quote: No. 1 Foundry, $18; No. 2, $17; Grey Forge, $14.50 to $15.50.

In Scotch Pig there are but few transactions. We quote: Shotts, $21 to $21.50; Coltness, $21 to $21.50; Glengarnock, $19 to $19.50, to arrive; Gartsherrie, $20.50; Summerlee, $20.50; Carnbroe, $19, to arrive; Eglinton, $18 to $18.50; Langloan, $20.50; Dalmellington, $19.

Copper—The market for ingot is a little easier. Lake is held at 11.60 cents; other brands, 10.60 to 11 cents, but sales are made at lower figures.

Lead—The market is inactive at 3.65c.

Tin—We quote jobbing lots of Banca, 19c.; Straits and Malacca, 18¾c.

Spelter—Refined, 8c. to 8¾c.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Boy 16 years old, wants to learn patternmaking. J. O'Connell, 186 6th Street, Jersey City, N. J.

Wanted—A draftsman to get out specifications for four or five sizes of a cheap engine. Address, Kendall, AM. MACHINIST.

Wanted, two or three good vise hands, used to fitting lathe and planer work. Address, Joseph B. Reed, Cairo, Ill.

Wanted—Situation by experienced die sinker and toolmaker; best of reference given. Address Experience, BOX 1, AM. MACHINIST.

Mech. draftsman, thorough education, practical experience, wants situation. Best references from former and present employers. BOX 15, AM. MACH.

Mech. draftsman requires situation, several years practical experience in nearly all classes of machinery. Address, "J. D," BOX 14, AM. MACHINIST.

Wanted—Position as traveling salesman, anywhere in North or South America, by a young man of good character and education. Address C. E.C., Box 2776, Ann Arbor, Mich.

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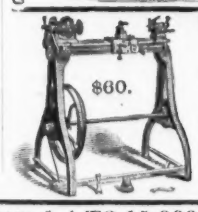

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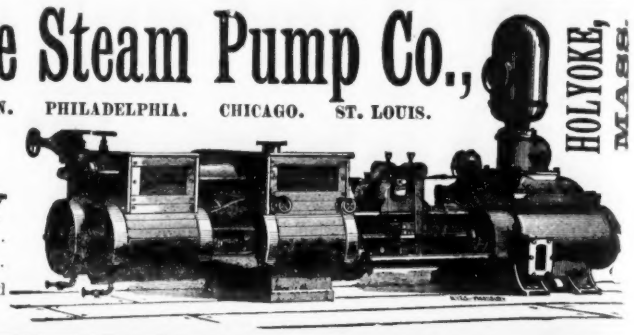

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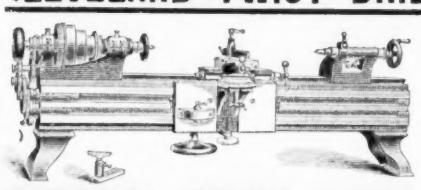
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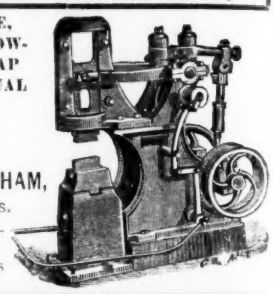

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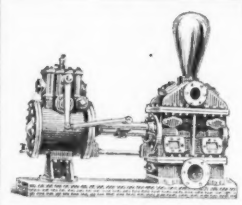
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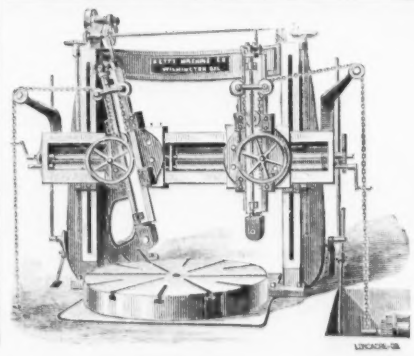
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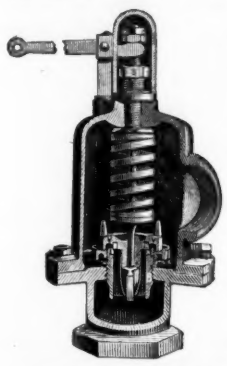

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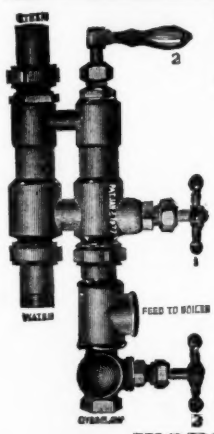

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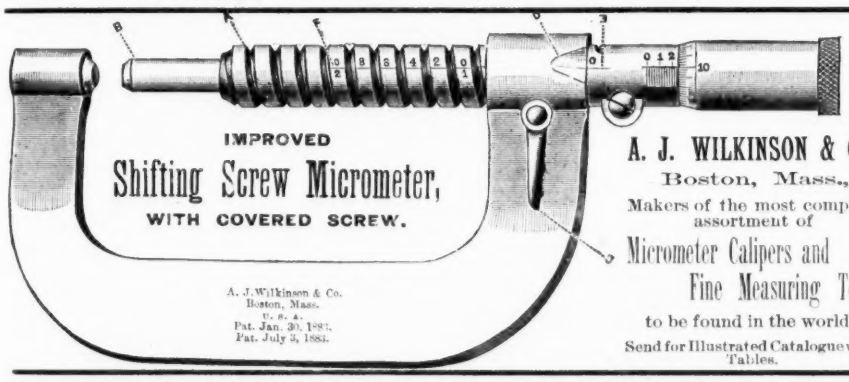

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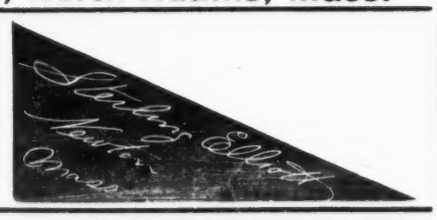

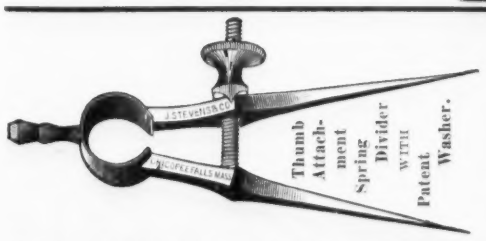

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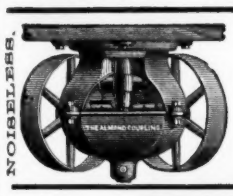

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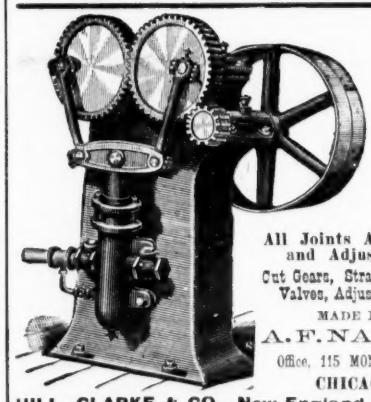

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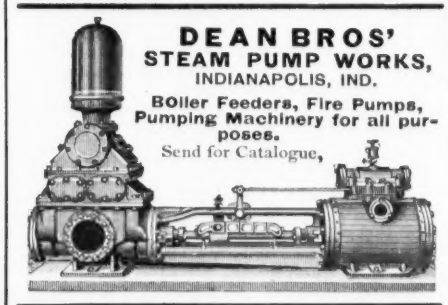

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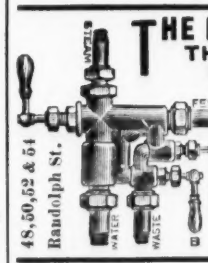

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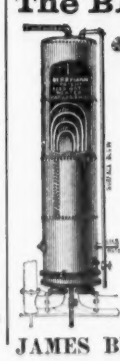

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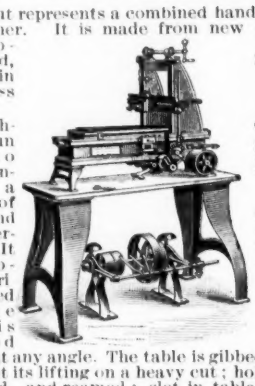

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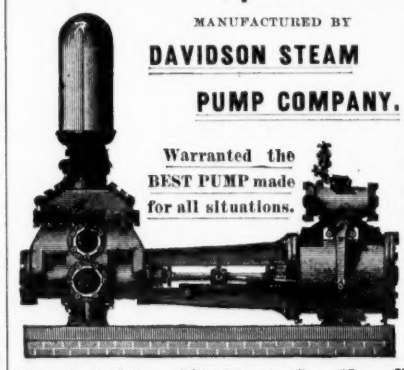

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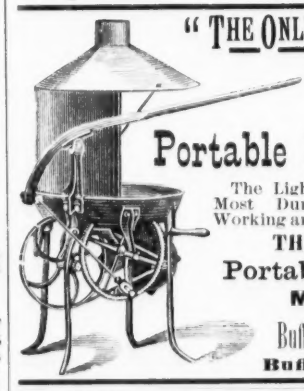

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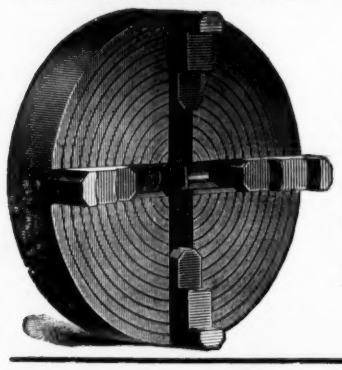

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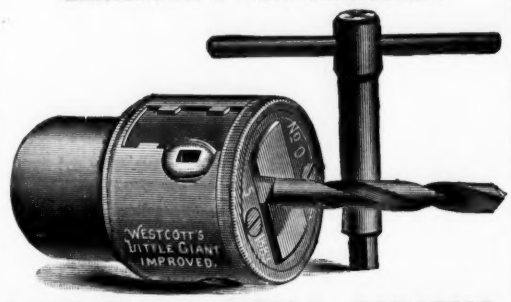

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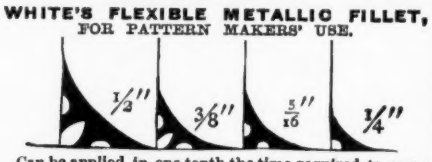

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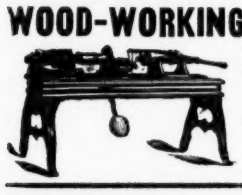

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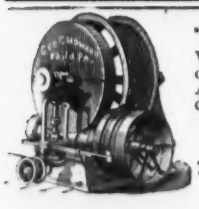

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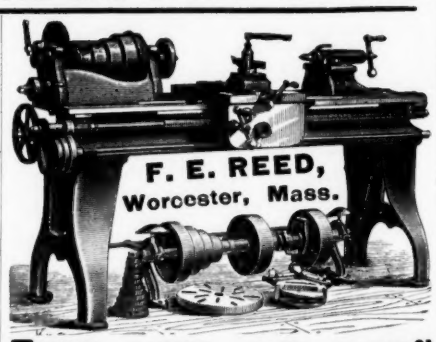

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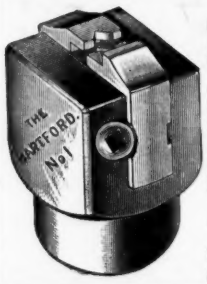

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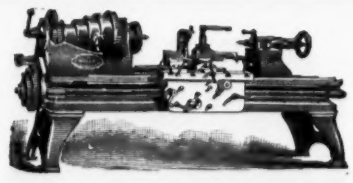

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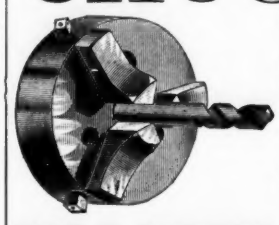

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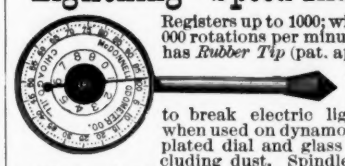

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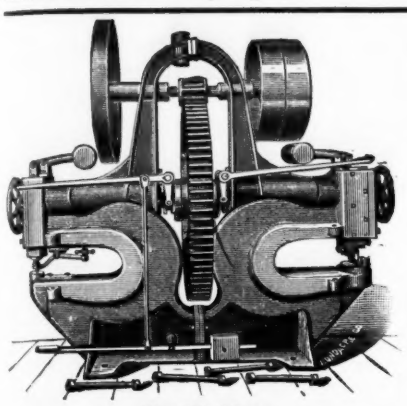

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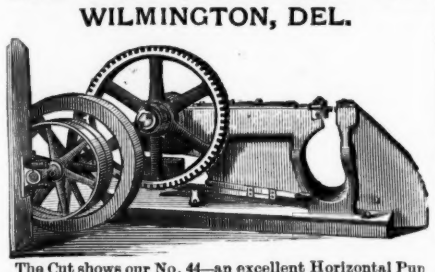

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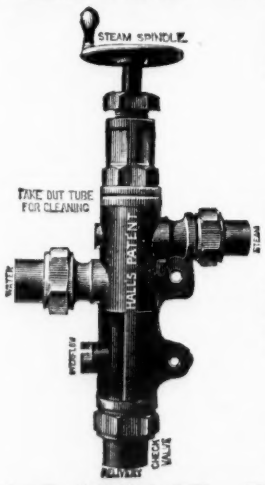

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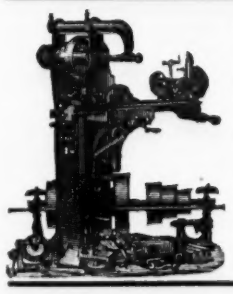

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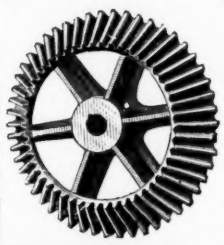

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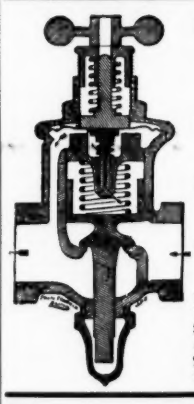

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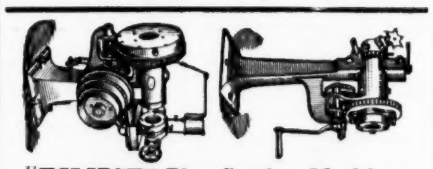

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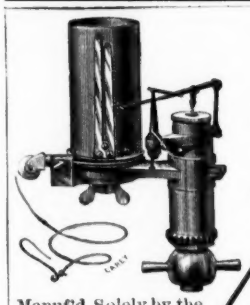

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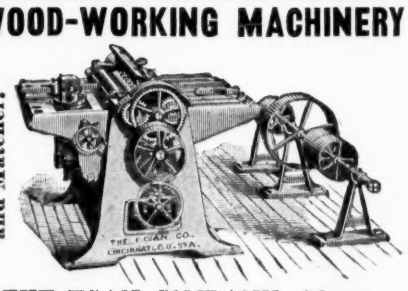

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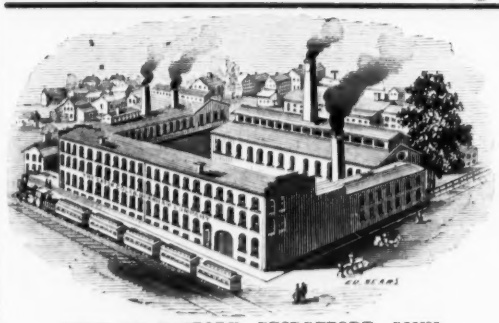

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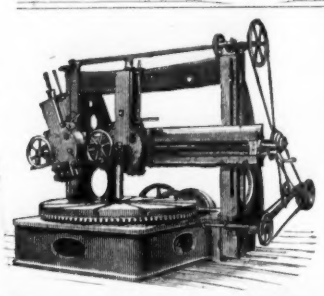

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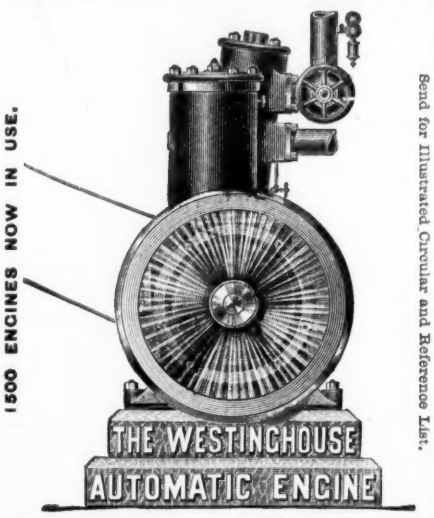

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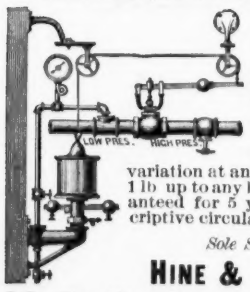

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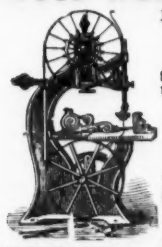

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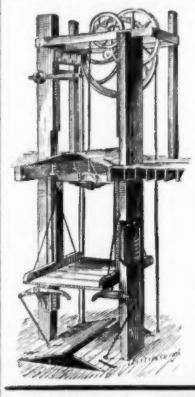

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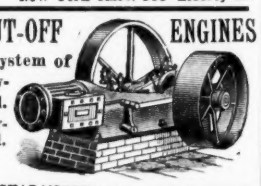

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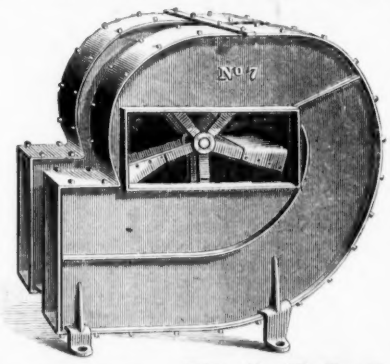

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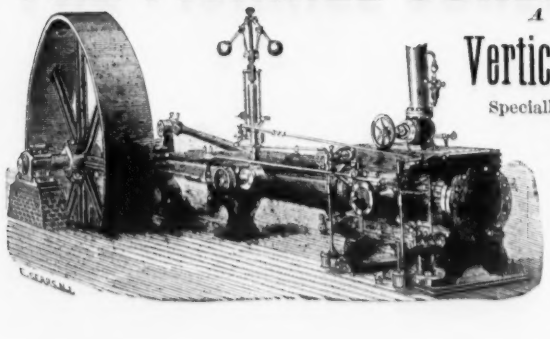

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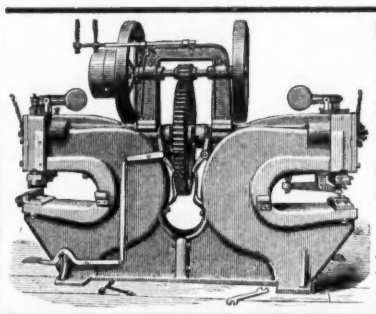

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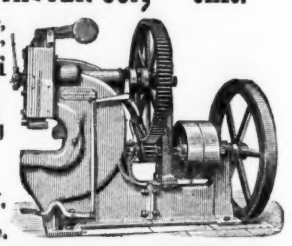

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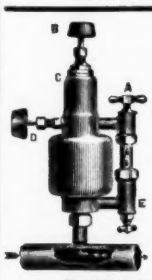

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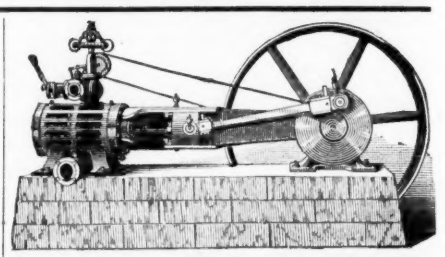

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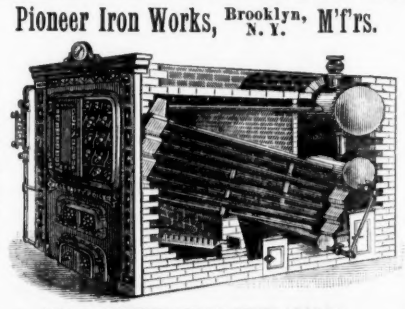

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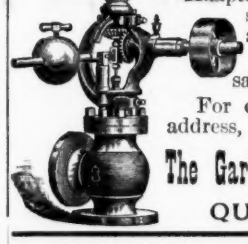

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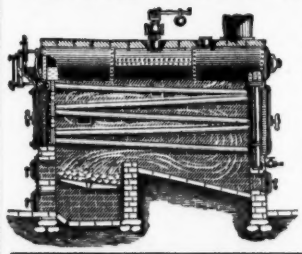

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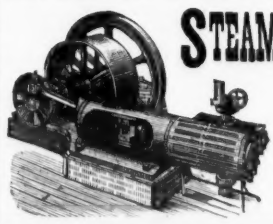

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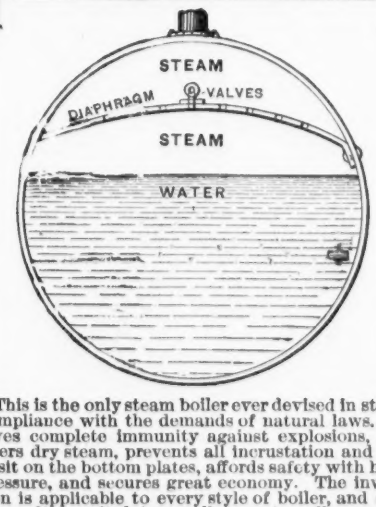

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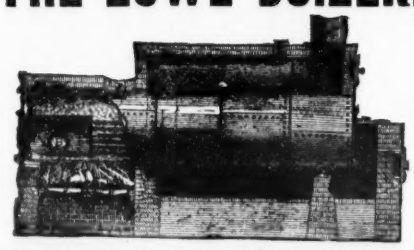

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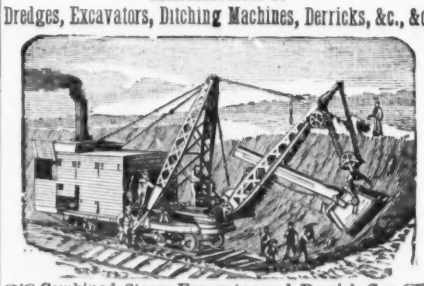

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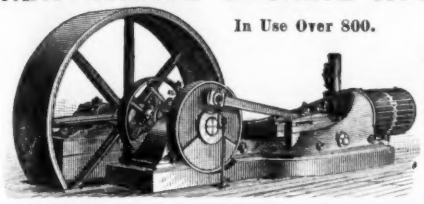

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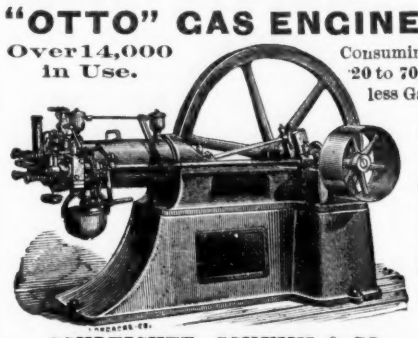

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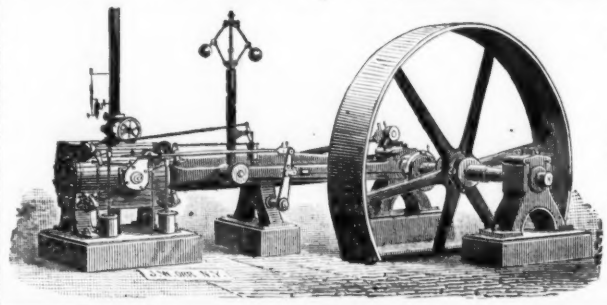

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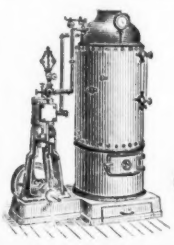

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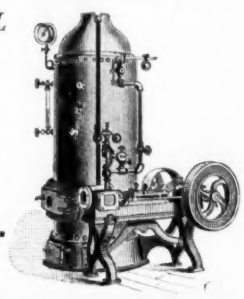

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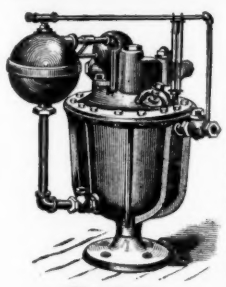

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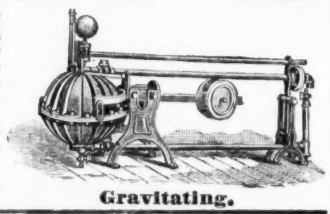

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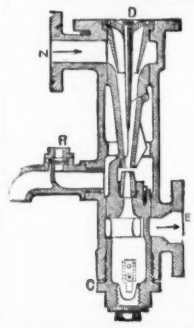

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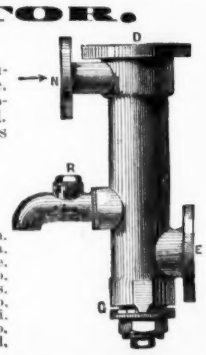

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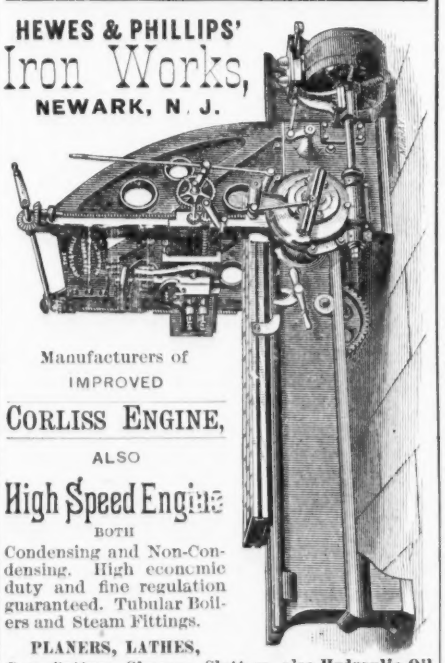

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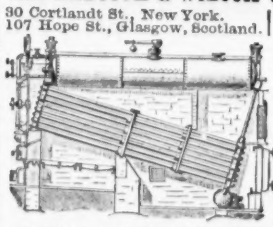

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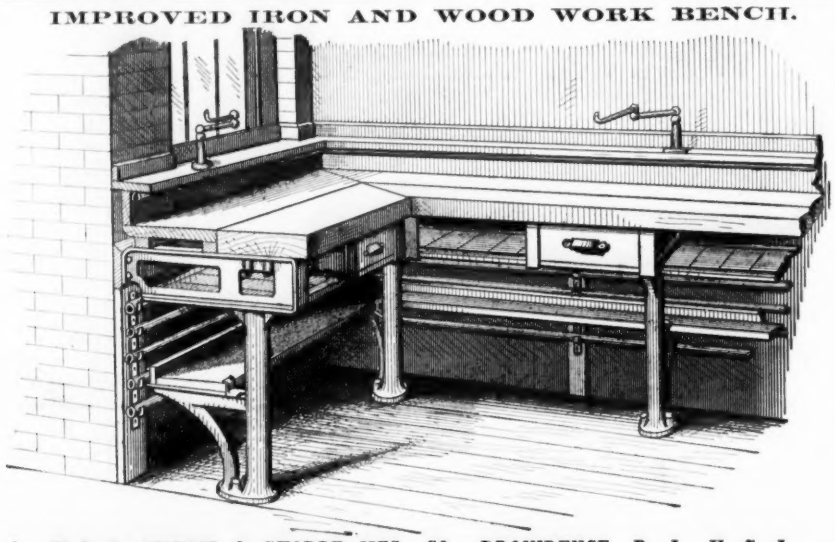

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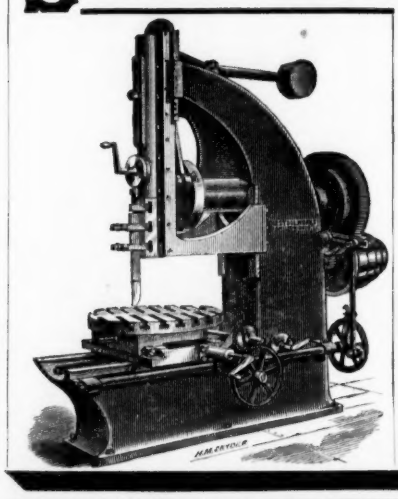

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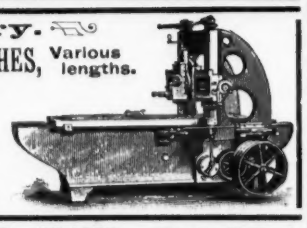

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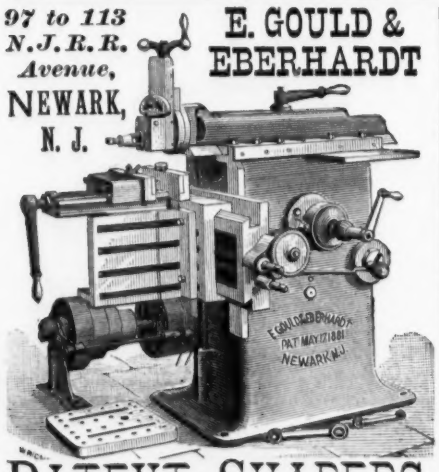

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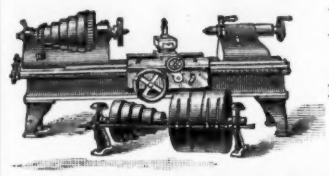

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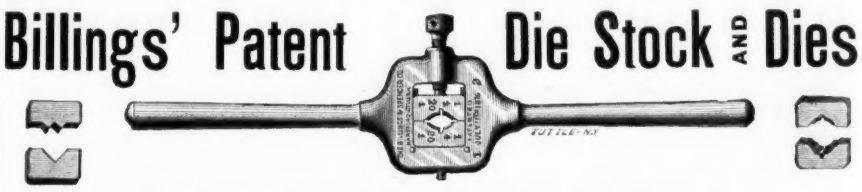

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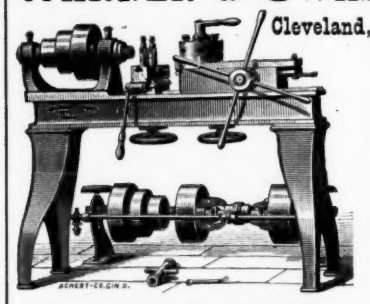

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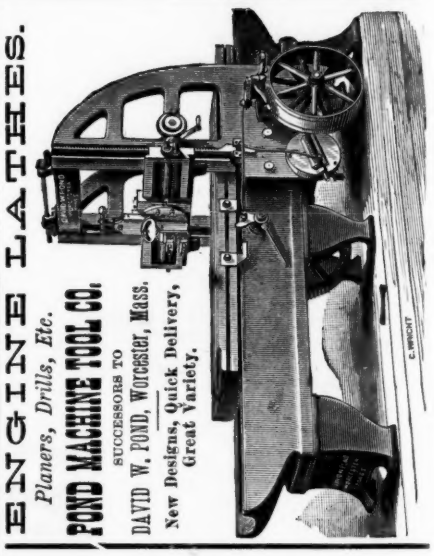

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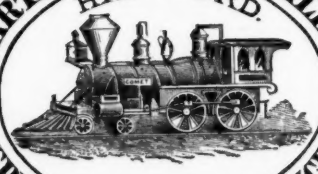

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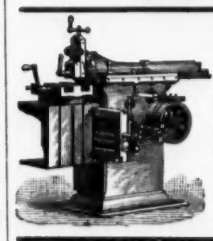

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